NEVADA ENVIRONMENTAL RESPONSE TRUST

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2019 ANNUAL STAKEHOLDER MEETING

MARCH 20, 2019

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BMI COMPLEX UPDATE

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

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AGENDA

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

2019 ANNUAL STAKEHOLDER MEETING

AGENDA

- Opening Remarks
- BMI Complex Update
- Annual Recap and Look Ahead
- NERT Overview
- NERT Remedial Investigation
  - Remedial Program Summary
  - OU-1 / OU-2 RI Status
  - OU-1 / OU-2 Conceptual Site Model
  - OU-3 / Downgradient RI Status
  - RI Path Forward

2019 ANNUAL STAKEHOLDER MEETING

AGENDA

- NERT Feasibility Study
  - Overview of Ongoing Studies
    - UNLV Bench Scale Studies
    - Galleria Drive Bioremediation
    - Galleria Drive ZVI
    - In-Situ Bioelectrochemical
    - Unit 4 In-Situ Source Area Bioremediation
    - Hydrogen Gas Permeable Membrane
    - New 2019 Studies
    - SWF Area Bioremediation Treatability Study Modification
    - Las Vegas Wash Bioremediation Pilot Study

2019 ANNUAL STAKEHOLDER MEETING

AGENDA

- Feasibility Study Path Forward
- Putting It All Together
  - Path to Remedy Implementation for OU-1 / OU-2 / OU-3
  - Program Schedule to Remedy Implementation
- OU-1 Containment and Source Reduction Conceptual Alternatives
- GWETS
  - Facility Status
  - Treatment System Extension
  - AP-5 Project Status
  - Weir Dewatering Treatment Plant System Decommissioning
- Questions / Closing Remarks

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ANNUAL RECAP & LOOK AHEAD

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

ANNUAL RECAP & LOOK AHEAD

ORGANIZATIONAL CHART

NDEP / US EPA

NERT

RAMBOLL *(2011 – present)*
- RI Investigation, Risk Assessments, and Treatability Studies
- RI Reporting Lead
- GWM Reporting & Modeling Lead

TETRA TECH *(2013 – present)*
- Treatability / Pilot Studies & Unit Building RI Investigation
- Engineering & Site Management Services
- GWETS Projects & Oversight

ARCADIS *(2017 – present)*
- Third-party cost review

NDEP

AECOM *(2015 – present)*
- Downgradient Investigation

ENVIROGEN TECHNOLOGIES *(2013 – present)*
- GWETS Operator

ANNUAL RECAP AND LOOK AHEAD

REMEDIAL INVESTIGATION

- Compiled initial comprehensive mass estimates for entire NERT RI Study Area
- Completed the Phase 2 Investigation including 15 Modifications
- Completed the Phase 3 (initial scope) Investigation including 3 Modifications
- Completed the Unit 4 / 5 investigation and Data Validation Summary Report
- Nature and extent of contamination in OU-1 and OU-2 has been defined
  - Characterized the extent of contamination in the Eastside Study Area
  - Defined vertical extent of contamination within the Upper Muddy Creek formation
- The locations where perchlorate-impacted groundwater discharges to the Las Vegas Wash are being thoroughly investigated
- Began preparation of RI Report for OU-1 and OU-2

ANNUAL RECAP AND LOOK AHEAD

FEASIBILITY STUDY

- Received approval on three treatability study reports (AP Area Down and Up Flushing Treatability Study, VER Treatability Study, and In-Situ Chromium Treatability Study)
- Received approval on two work plans (Unit 4 Source Area In-Situ Bioremediation Treatability Study and In-Situ Bioelectrochemical Laboratory-Scale Treatability Study)
- Preparation of six treatability/pilot study modifications
- Completed Phase 1 efforts on two studies (Galleria Dr Bioremediation Treatability Study and Las Vegas Wash Bioremediation Pilot Study)
- Simultaneous implementation of eight treatability/pilot studies
- 2019 studies focus on innovation and cost effectiveness
- Initial screening of remedial action alternatives for OU-1 underway
- Began preparation of financial modeling to support FS cost estimates

ANNUAL RECAP AND LOOK AHEAD

OTHER ENVIRONMENTAL

- SNWA Weir Dewatering Treatment
  - 860MG of groundwater treated; mitigated 6,000 lbs perchlorate from Lake Mead
  - Maintained over 99.9% uptime
  - Decommissioning progressing and scheduled for completion in early April
- GWETS
  - Sustained highest GWETS extraction rates since 2004
  - Maintained over 96.4% GWETS uptime
- AP-5
  - Completed pond transfer; destroyed approximately 400,000 lbs of perchlorate
  - Completed physical closure of AP-5 pond
  - Anticipate start of solids management in 2Q 2020

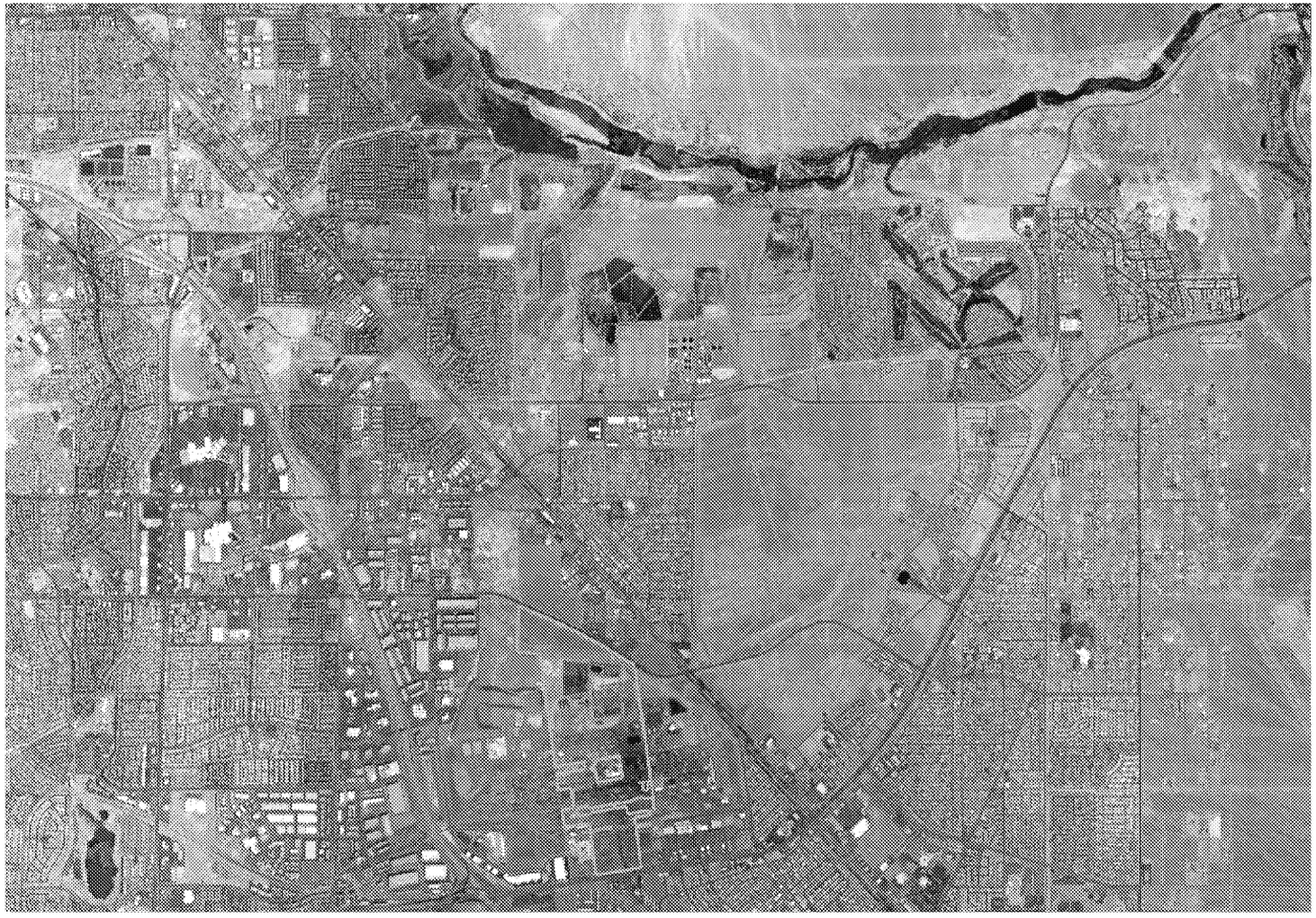
ANNUAL RECAP AND LOOK AHEAD

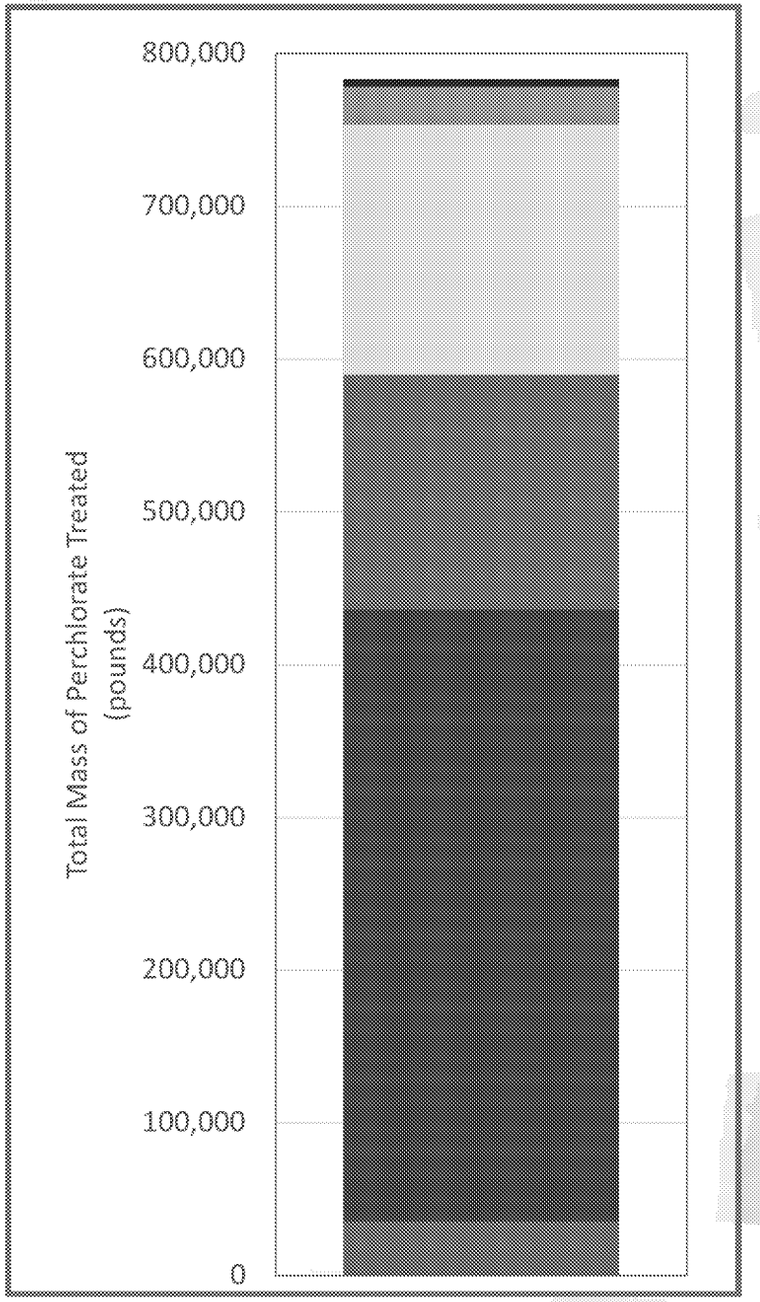
STAKEHOLDER INVOLVEMENT

- 133 work plans, tech memos, and reports submitted to Stakeholders in 2018
- 5 meetings / roundtables in 2018
- Anticipated 2019 roundtables
  - Galleria Drive Bioremediation Treatability Study Addendum
  - Las Vegas Wash Pilot Study Addendum
  - Galleria Drive ZVI Treatability Study Addendum
  - Unit 4 Source Area In-Situ Bioremediation Treatability Study Addendum
  - In-Situ Bioelectrochemical Laboratory-Scale Treatability Study Addendum
  - OU-1 / OU-2 RI Report Q&A
  - Phase 6 Groundwater Model
  - OU-2 Conceptual Remedial Alternatives Roundtable

ANNUAL RECAP & LOOK AHEAD

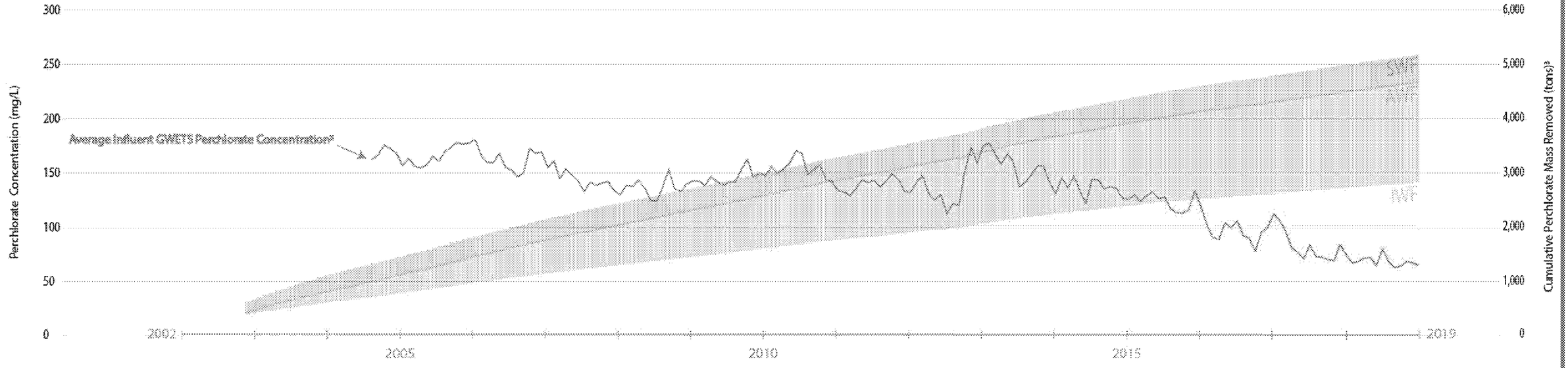
PERCHLORATE MASS REMOVAL: MARCH 2018 – FEBRUARY 2019





ANNUAL RECAP & LOOK AHEAD

PERCHLORATE MASS REMOVAL: 2002 – FEBRUARY 2019



~10,854,000 pounds!

- GWETS – 10,415,000 lbs
- AP Treatment – 397,000 lbs
- Treatability Studies – 35,800 lbs
- Weir Dewatering Treatment Plant – 6,000 lbs

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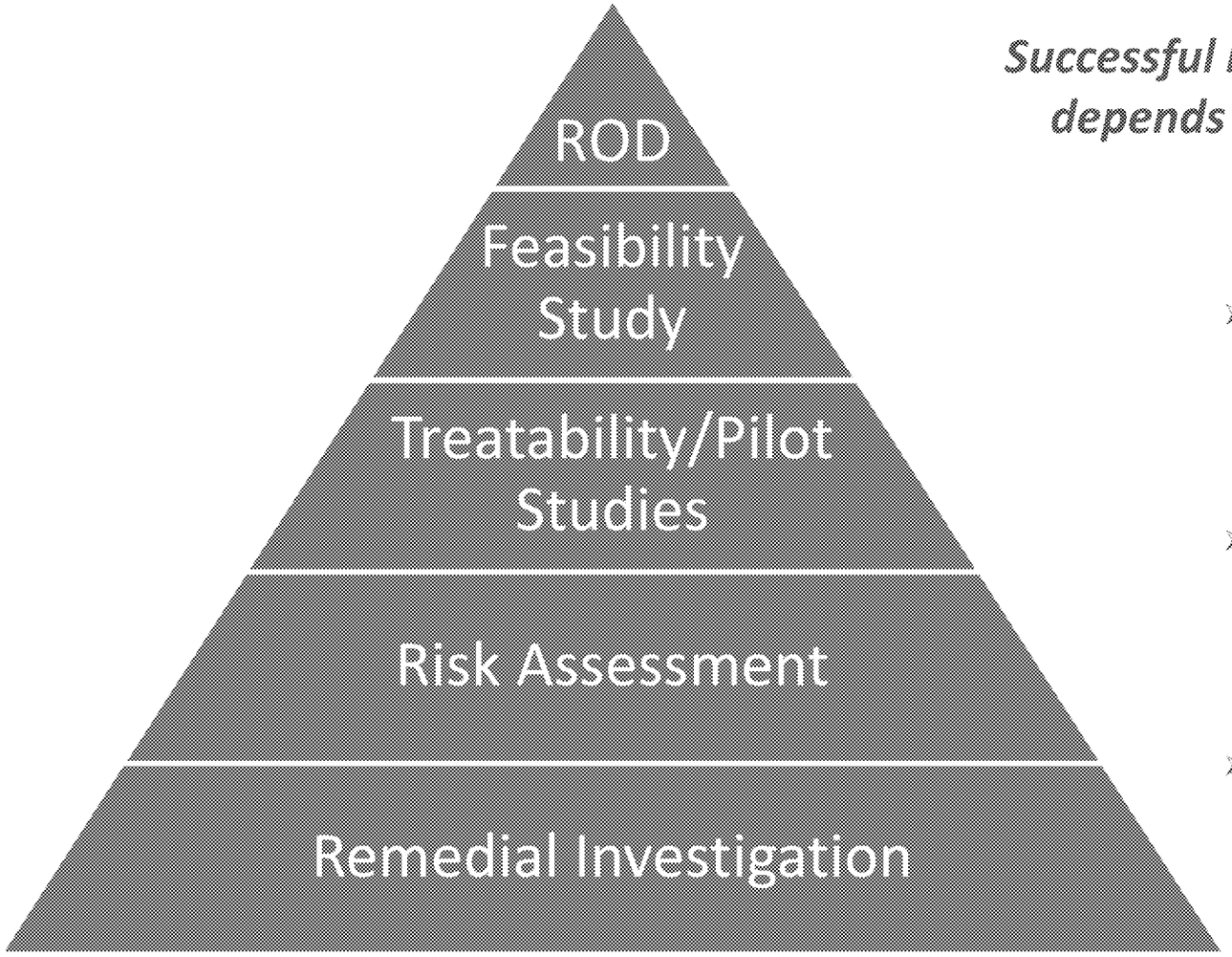
NERT OVERVIEW

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

NERT OVERVIEW

NERT REMEDIAL PROGRAM

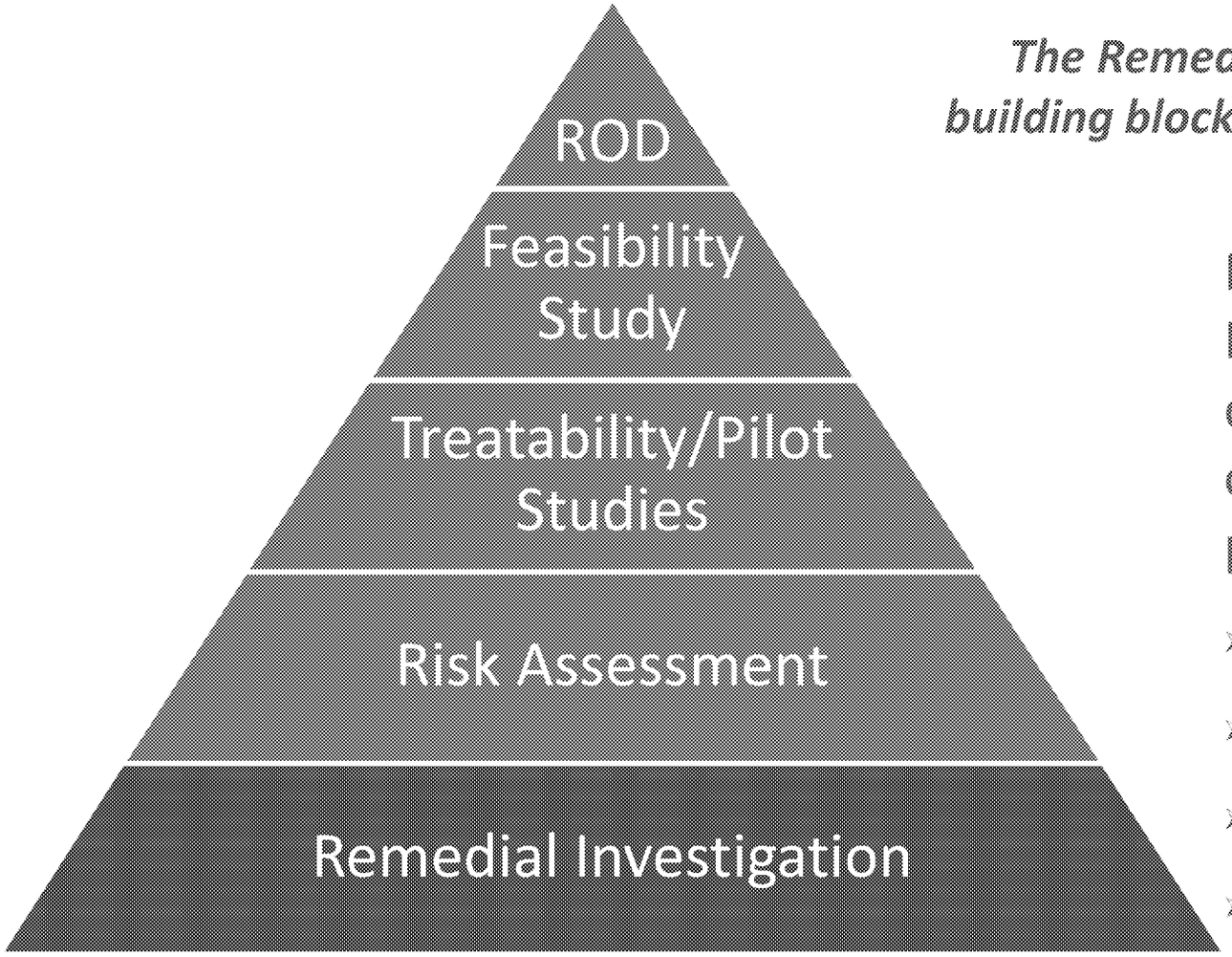


Successful remediation within OU-1, OU-2, and OU-3 depends on a strong foundation of scientific and engineering knowledge

- The nature and extent of contamination must be well understood
- Migration pathways must be identified to mitigate migration to drinking water sources
- The risk to human health and the environment must be evaluated to identify where unacceptable risk exists

NERT OVERVIEW

NERT REMEDIAL PROGRAM



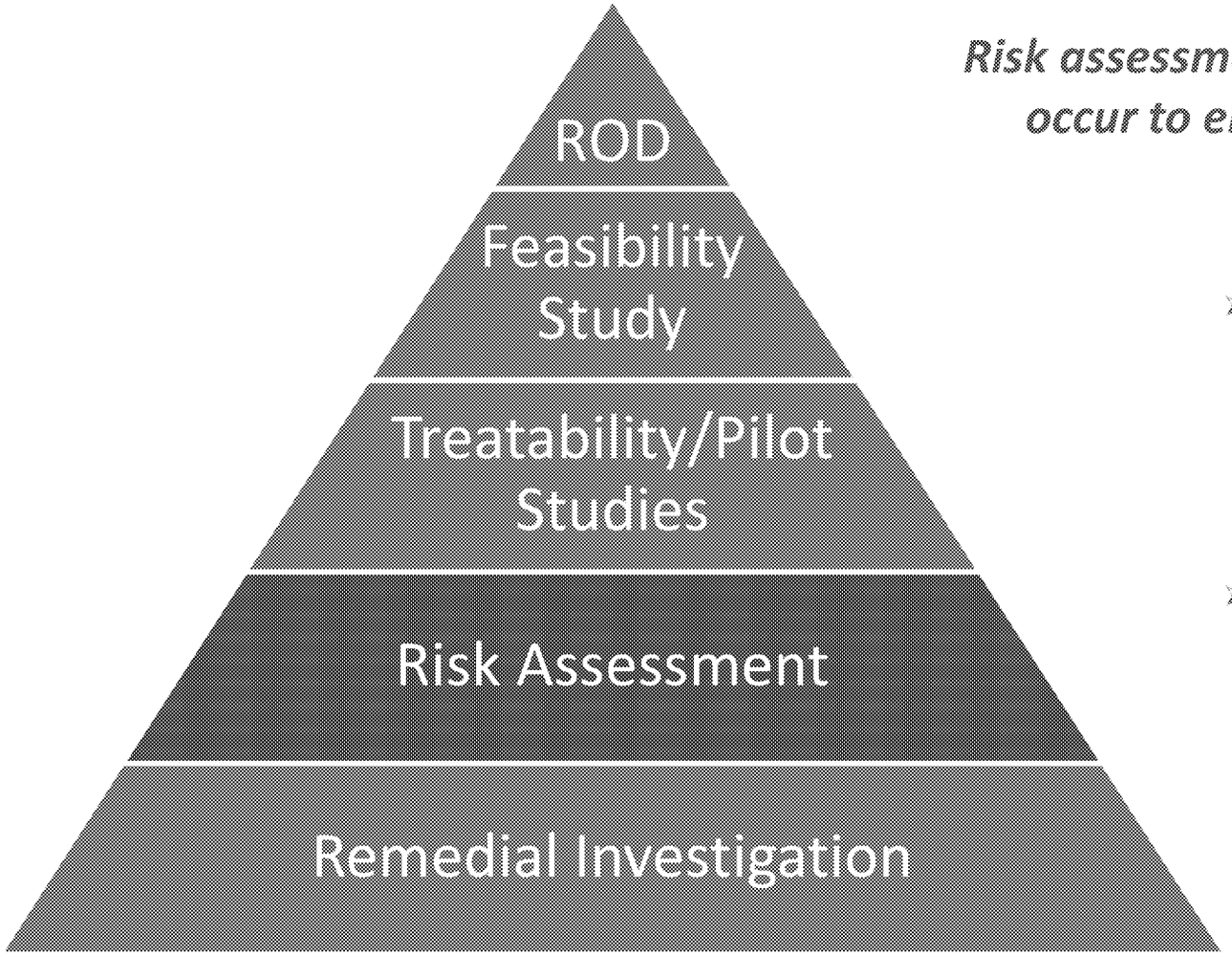
The Remedial Investigation is the most fundamental building block to addressing environmental contamination

NERT is completing a Remedial Investigation to characterize source areas, determine the nature and extent of contamination, and identify migration pathways

- Phase 1, 2, and 3 RI field activities
- RI Report for OU-1 / OU-2
- RI Report for OU-3
- Groundwater model

NERT OVERVIEW

NERT REMEDIAL PROGRAM



Risk assessments identify areas where remediation must occur to eliminate unacceptable risk to human and ecological receptors

- OU-1 Soil Baseline Risk Assessment

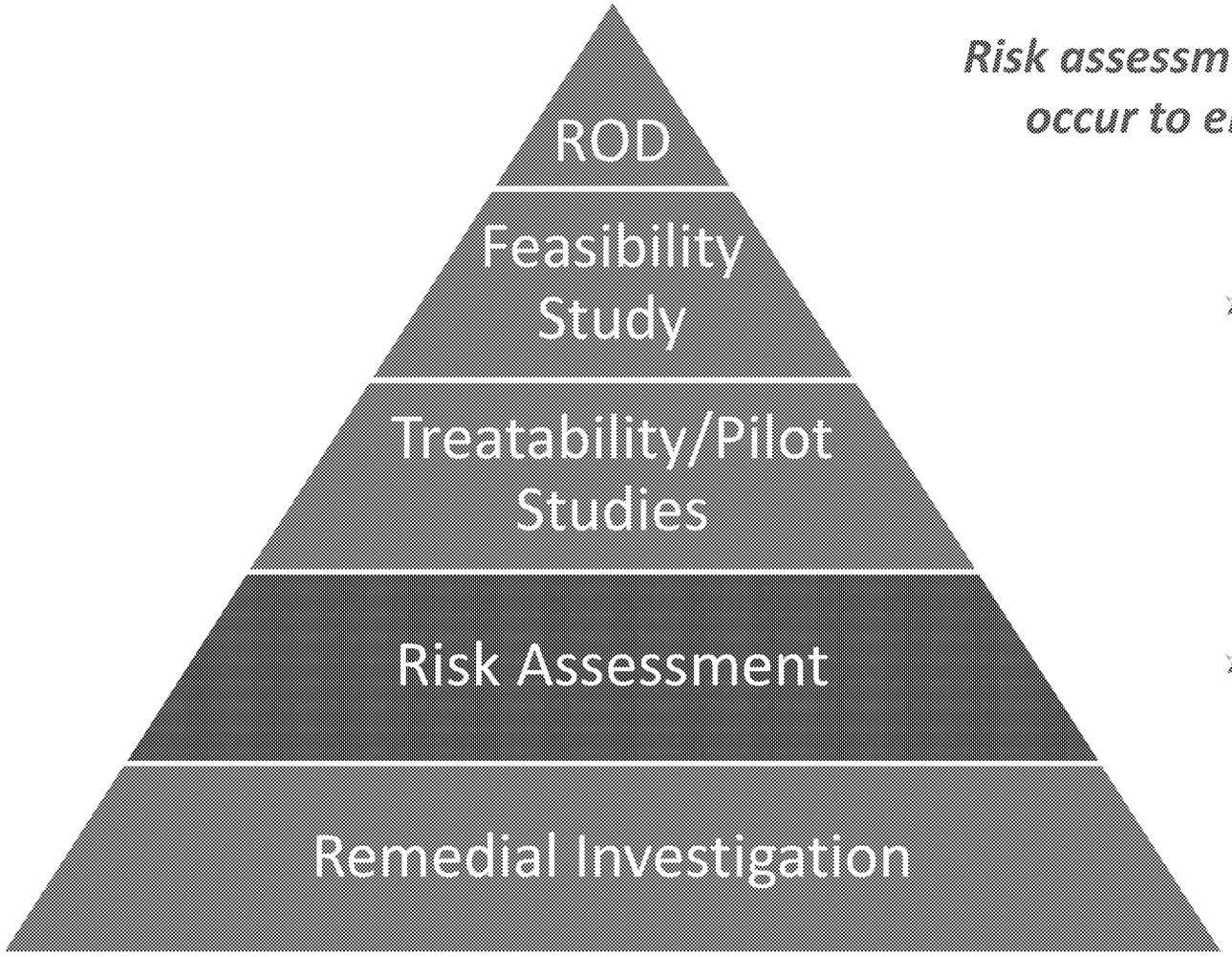
  Determine if contaminants in soil pose an unacceptable risk to workers at the NERT Site

- OU-1 / OU-2 /OU-3 Soil Gas and Groundwater Health Risk Assessments

  Determine if contaminants in soil gas and groundwater pose an unacceptable risk to workers at the NERT Site and residents living within the NERT RI Study Area

NERT OVERVIEW

NERT REMEDIAL PROGRAM



Risk assessments identify areas where remediation must occur to eliminate unacceptable risk to human and ecological receptors

- OU-1 / OU-2 Screening Ecological Risk Assessments

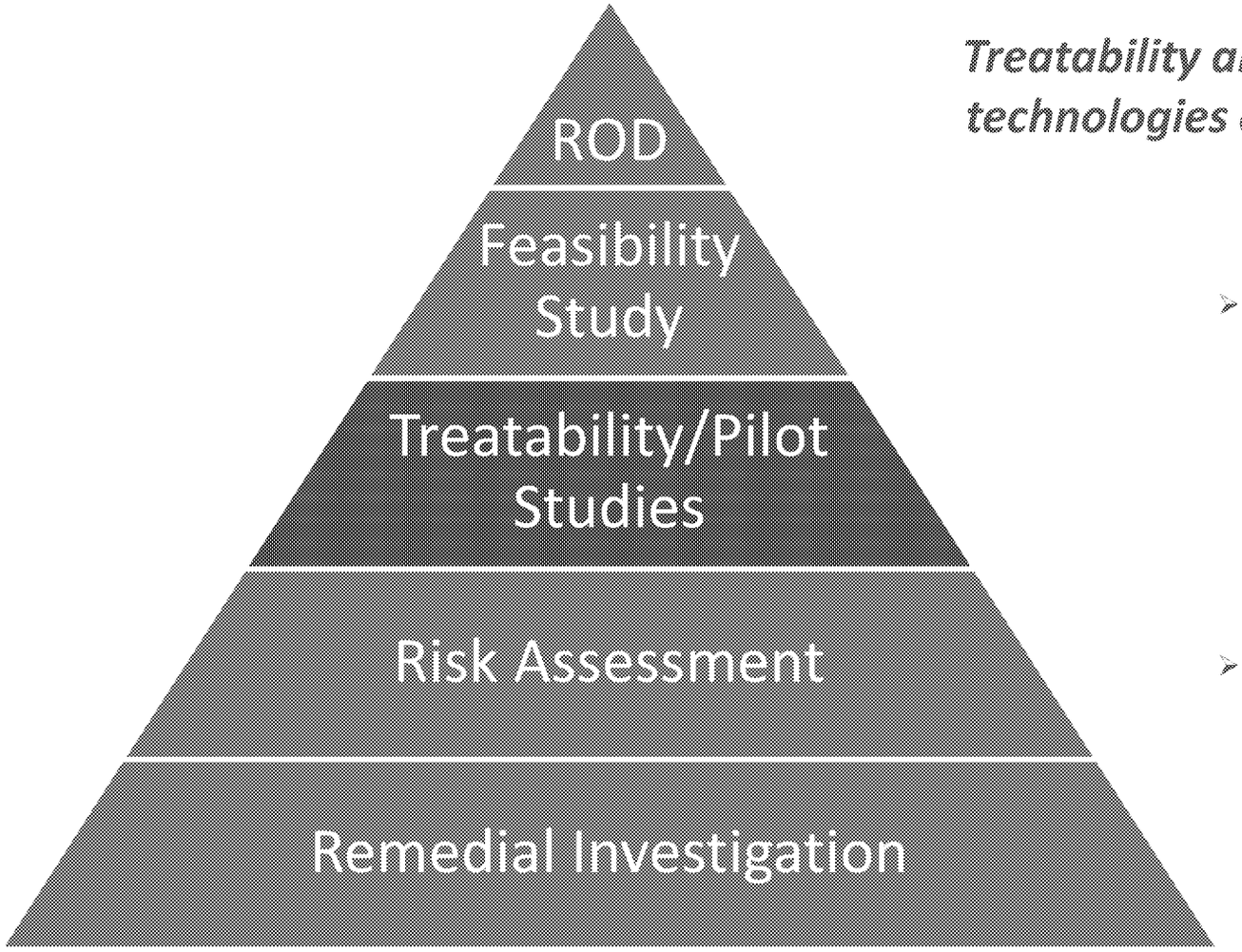
  Determine if contaminants in soil and groundwater pose an unacceptable risk to ecological receptors

- OU-3 Baseline Ecological Risk Assessment

  Determine if contaminants in soil, surface water, and groundwater pose an unacceptable risk to ecological receptors

NERT OVERVIEW

NERT REMEDIAL PROGRAM

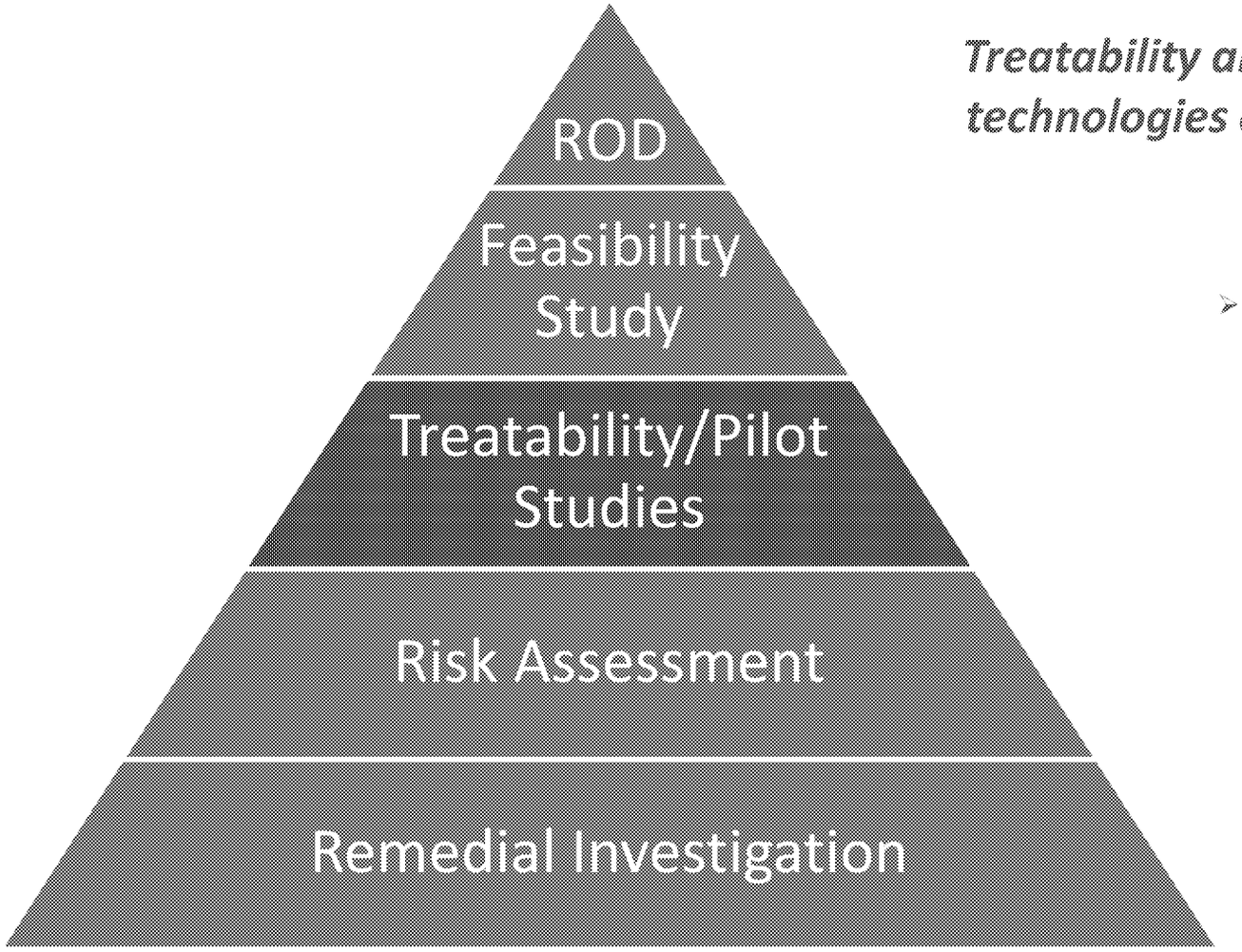


Treatability and Pilot studies evaluate whether remedial technologies can be successfully implemented given site conditions

- NERT conducts Treatability studies to validate potentially-applicable technologies given the limited "tried and true" remedial technologies applied at other perchlorate sites
- Pilot studies are more detailed evaluations designed to provide quantitative performance, cost and technology specific design information

NERT OVERVIEW

NERT REMEDIAL PROGRAM



Treatability and Pilot studies evaluate whether remedial technologies can be successfully implemented given site conditions

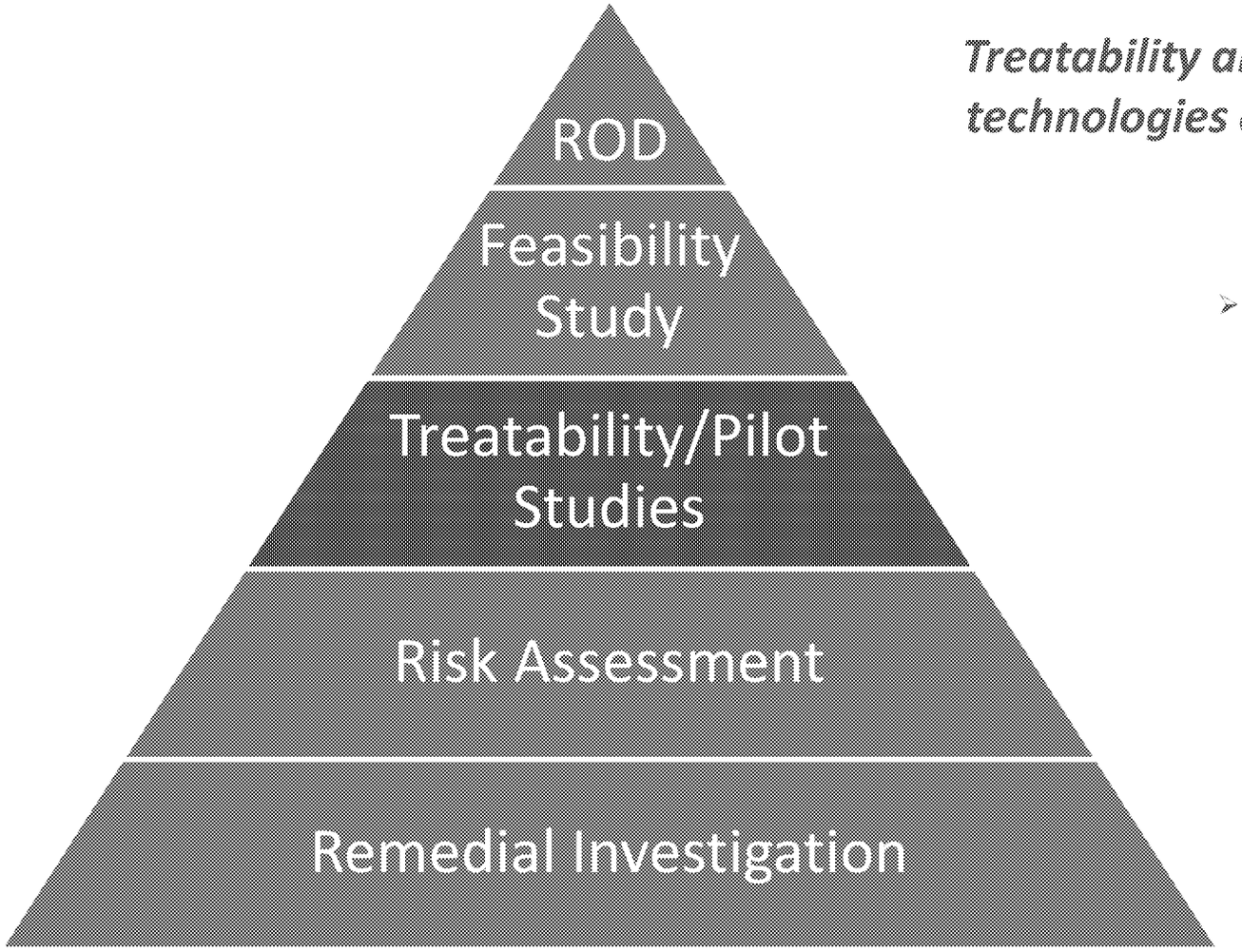
- SWF Area Bioremediation Treatability Study

  Designed to evaluate the bioremediation of perchlorate within the alluvium through the injection of carbon donor and the ability to maintain a biologically active zone of treatment

  Study extension will evaluate the ability to reduce the frequency of injections over time and assess the potential for biofouling

NERT OVERVIEW

NERT REMEDIAL PROGRAM



Treatability and Pilot studies evaluate whether remedial technologies can be successfully implemented given site conditions

- Galleria Drive Bioremediation Treatability Study

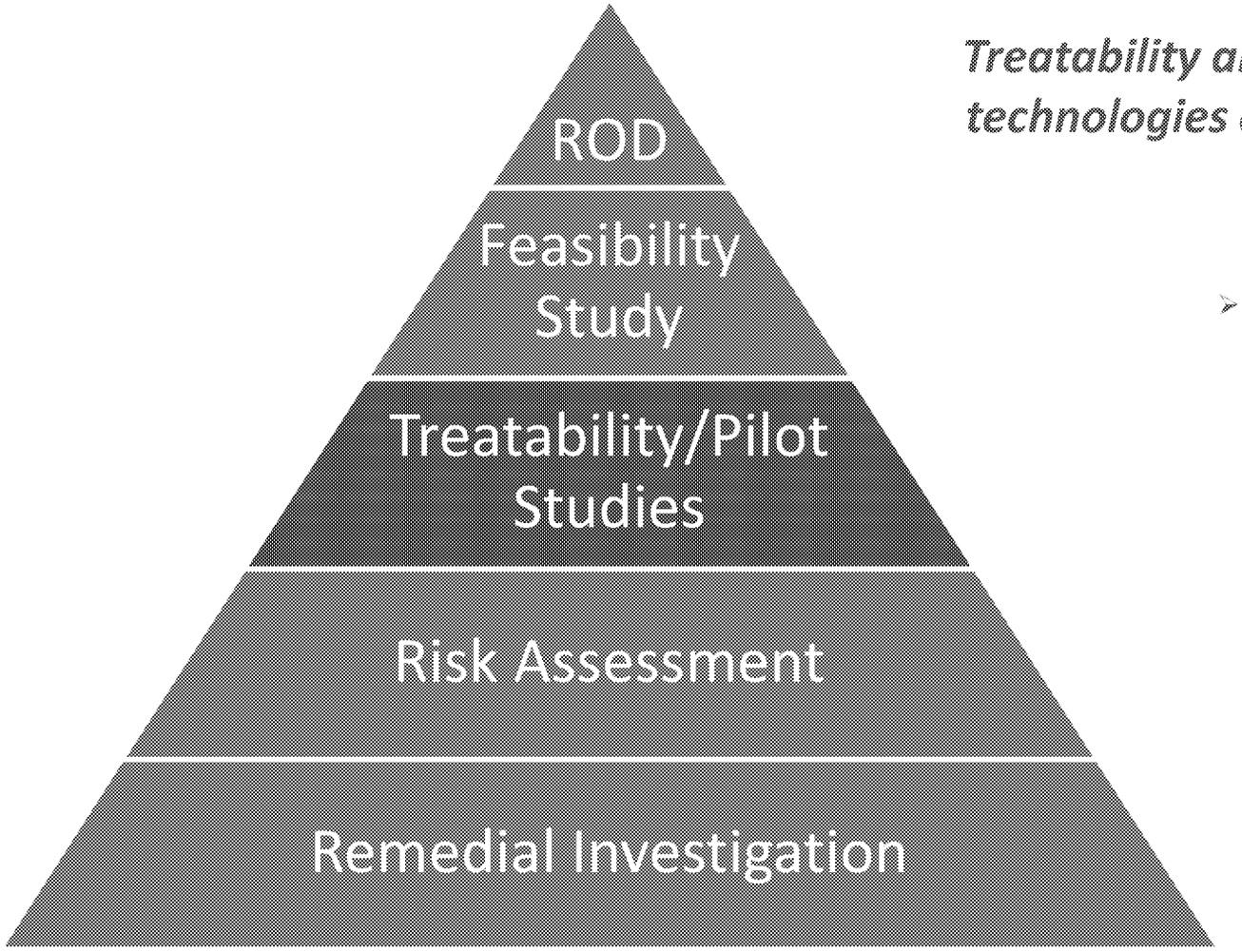
  NERT's first evaluation of perchlorate bioremediation within the UMCf at the OU-2 / OU-3 border through the injection of carbon donor

  Unique challenges include the unusually high concentrations of sulfate in groundwater

  Side-by-side comparison with ZVI

NERT OVERVIEW

NERT REMEDIAL PROGRAM



Treatability and Pilot studies evaluate whether remedial technologies can be successfully implemented given site conditions

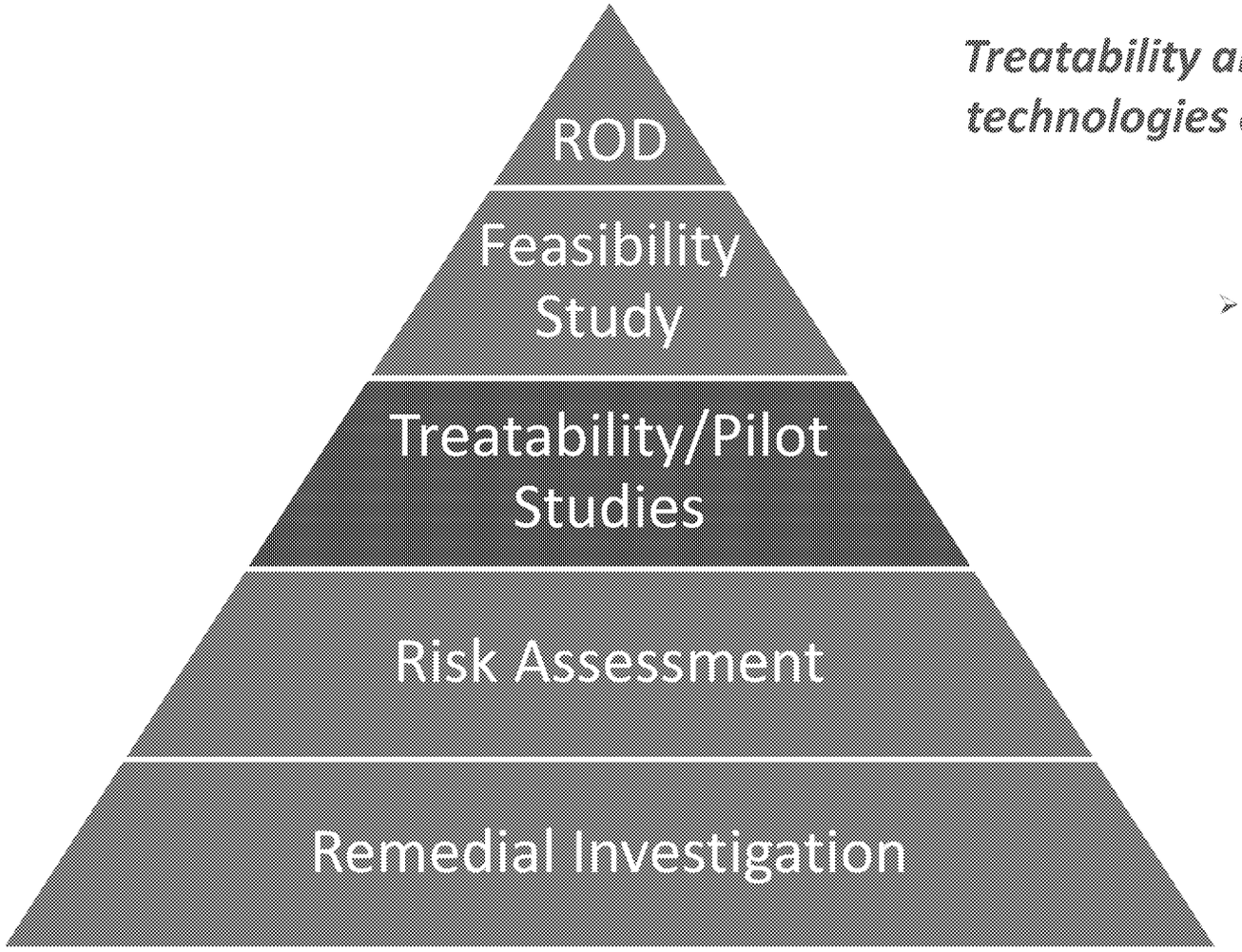
- Galleria Drive Zero Valent Iron Treatability Study

  NERT's first evaluation of perchlorate bioremediation within the UMCf at the OU-2 / OU-3 border through the emplacement of zero valent iron

  Side-by-side comparison with carbon donor injections

NERT OVERVIEW

NERT REMEDIAL PROGRAM



Treatability and Pilot studies evaluate whether remedial technologies can be successfully implemented given site conditions

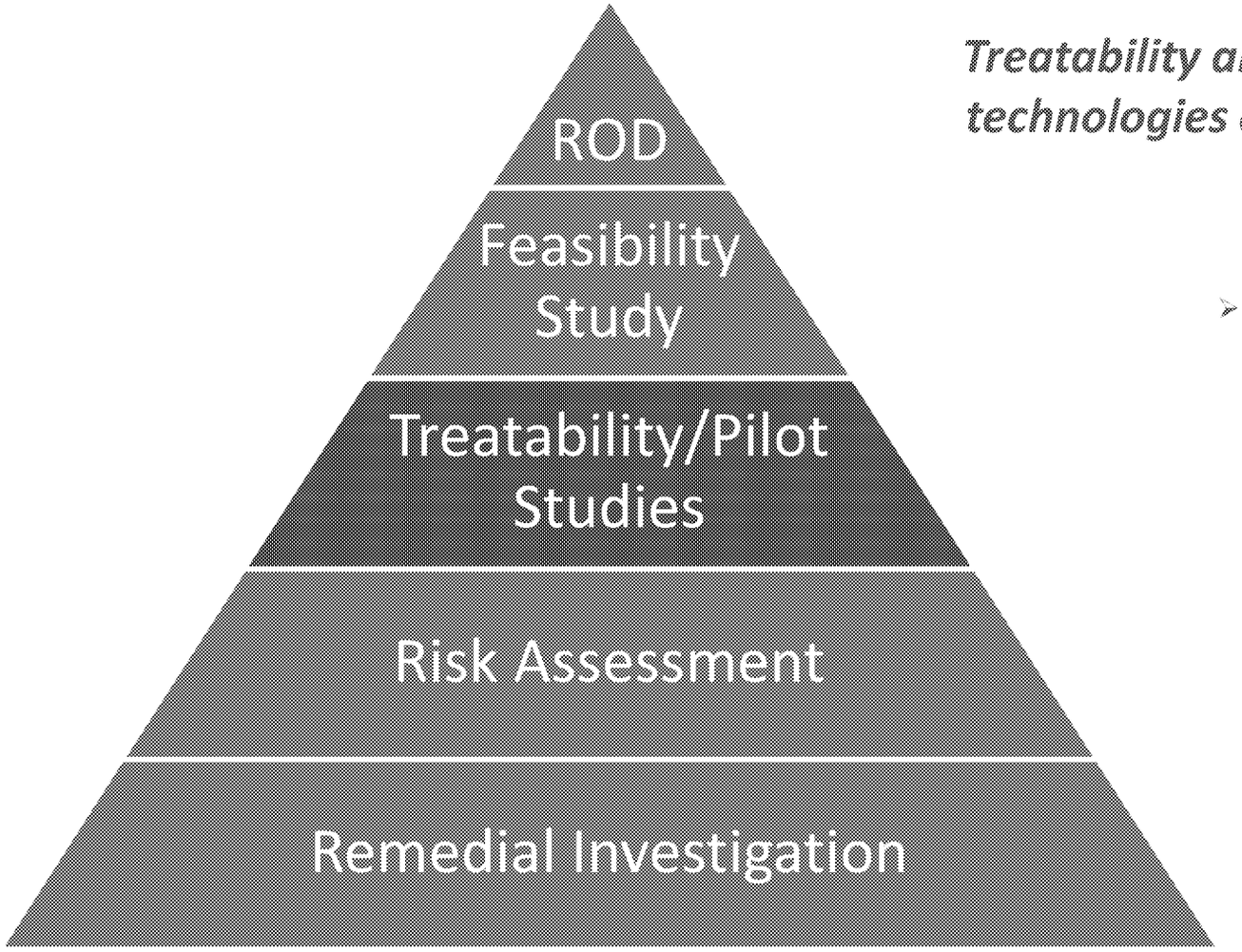
- Las Vegas Wash Bioremediation Pilot Study

  Necessary to evaluate design considerations for a bioremediation system within a geologically complex area where mass flux to the Las Vegas Wash is significant

  Study is critical for developing accurate cost estimates as part of the FS for a full-scale bioremediation system within OU-3

NERT OVERVIEW

NERT REMEDIAL PROGRAM



Treatability and Pilot studies evaluate whether remedial technologies can be successfully implemented given site conditions

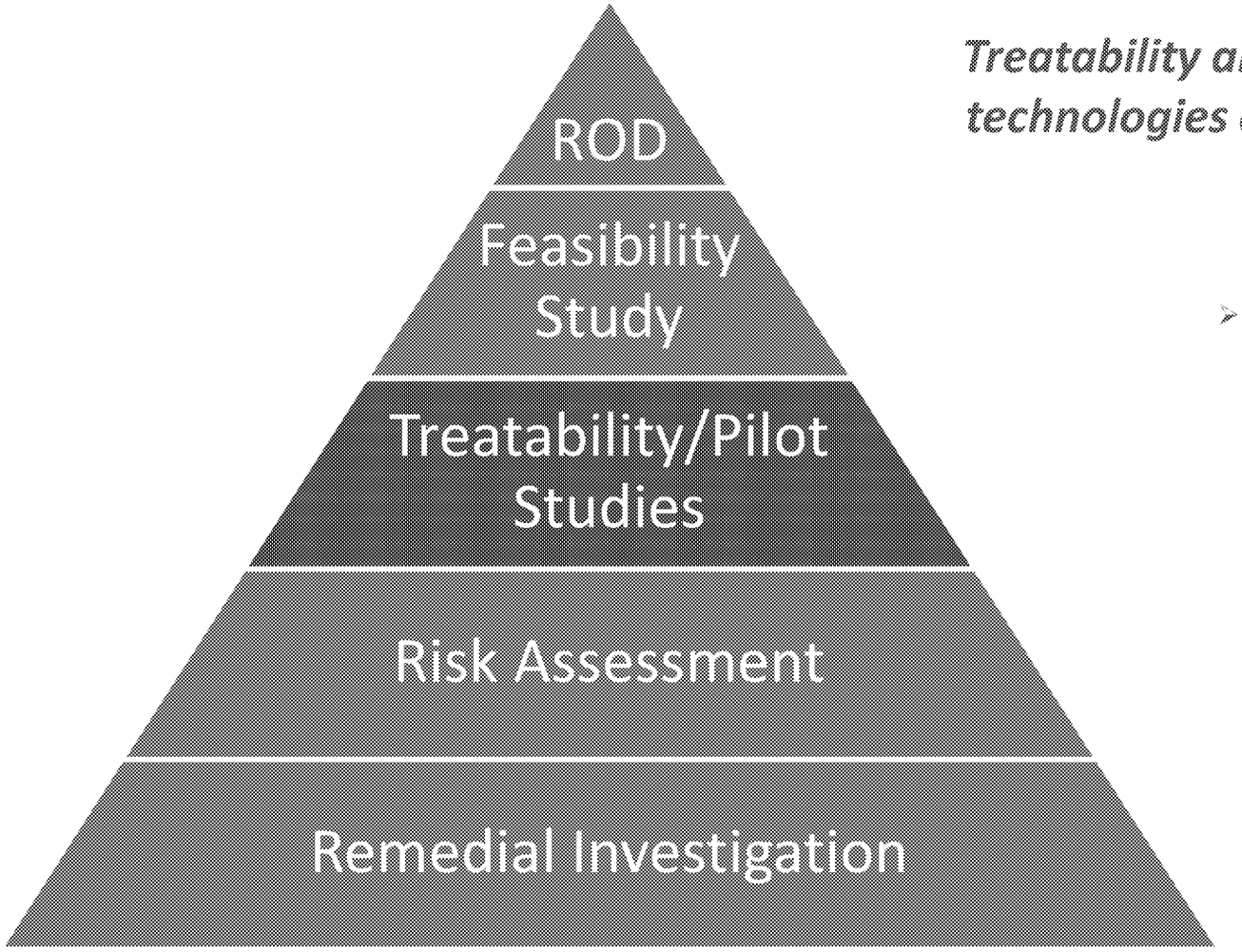
- Unit 4 Source Area In-Situ Bioremediation Treatability Study

  Critical to evaluate bioremediation in a source area with extremely high contaminant concentrations through the injection of carbon donor (and potentially nano-ZVI)

  Study is key to developing cost estimates for source reduction options at this area as part of the FS

NERT OVERVIEW

NERT REMEDIAL PROGRAM



Treatability and Pilot studies evaluate whether remedial technologies can be successfully implemented given site conditions

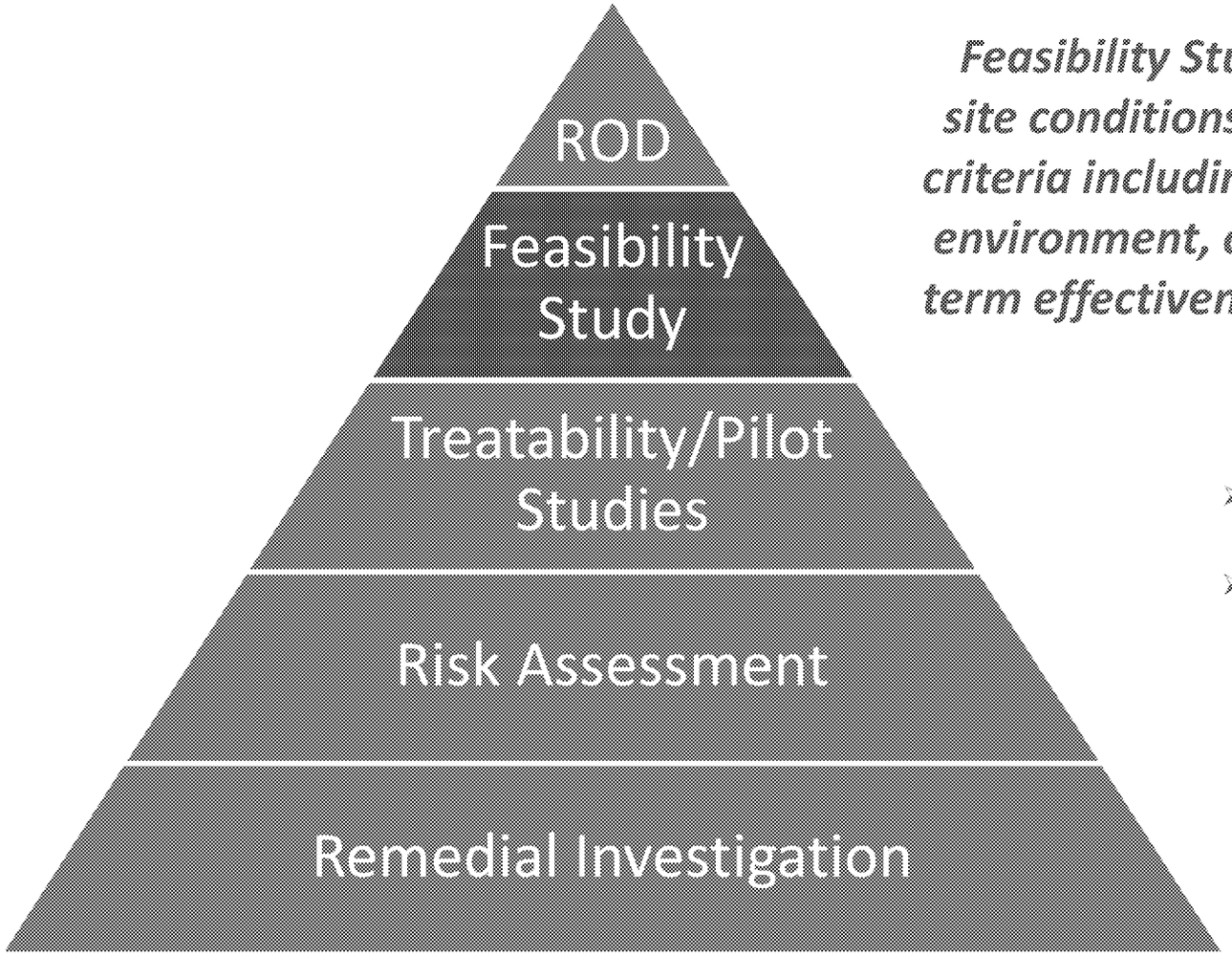
- In-Situ Bioelectrochemical Treatability Study

  Laboratory-scale study to evaluate bioremediation of perchlorate facilitated by coupling electrolytic hydrogen generation with naturally-occurring biological perchlorate reduction

  Unique opportunity to evaluate alternate technology that may result in a lower long-term operational cost

NERT OVERVIEW

NERT REMEDIAL PROGRAM

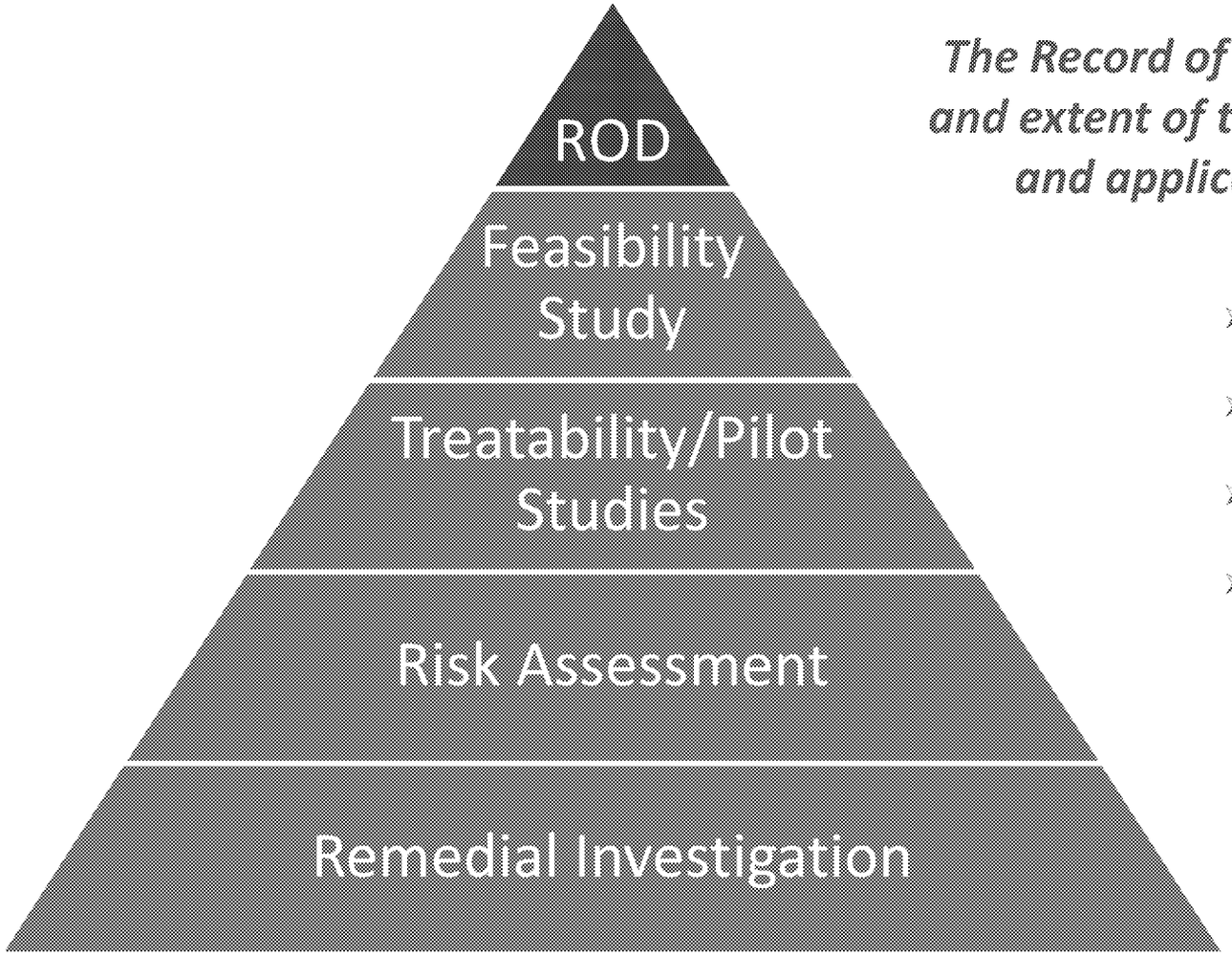


Feasibility Studies evaluate all the clean up options given site conditions and rank them based on a variety of critical criteria including overall protection of human health and the environment, compliance with ARARs, short-term and long-term effectiveness, reduction of toxicity, mobility, or volume, implementability, and cost

- Feasibility Study for OU-1 / OU-2
- Feasibility Study for OU-3

NERT OVERVIEW

NERT REMEDIAL PROGRAM



The Record of Decision can only be completed if the nature and extent of the problem, the risk posed by contamination, and applicable cleanup options are well understood

- Proposed Plan for OU-1 / OU-2
- Record of Decision for OU-1 / OU-2
- Proposed Plan for OU-3
- Record of Decision for OU-3

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NERT REMEDIAL INVESTIGATION

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

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REMEDIAL PROGRAM SUMMARY

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

NERT REMEDIAL INVESTIGATION

REMEDIAL PROGRAM SUMMARY

NERT Site

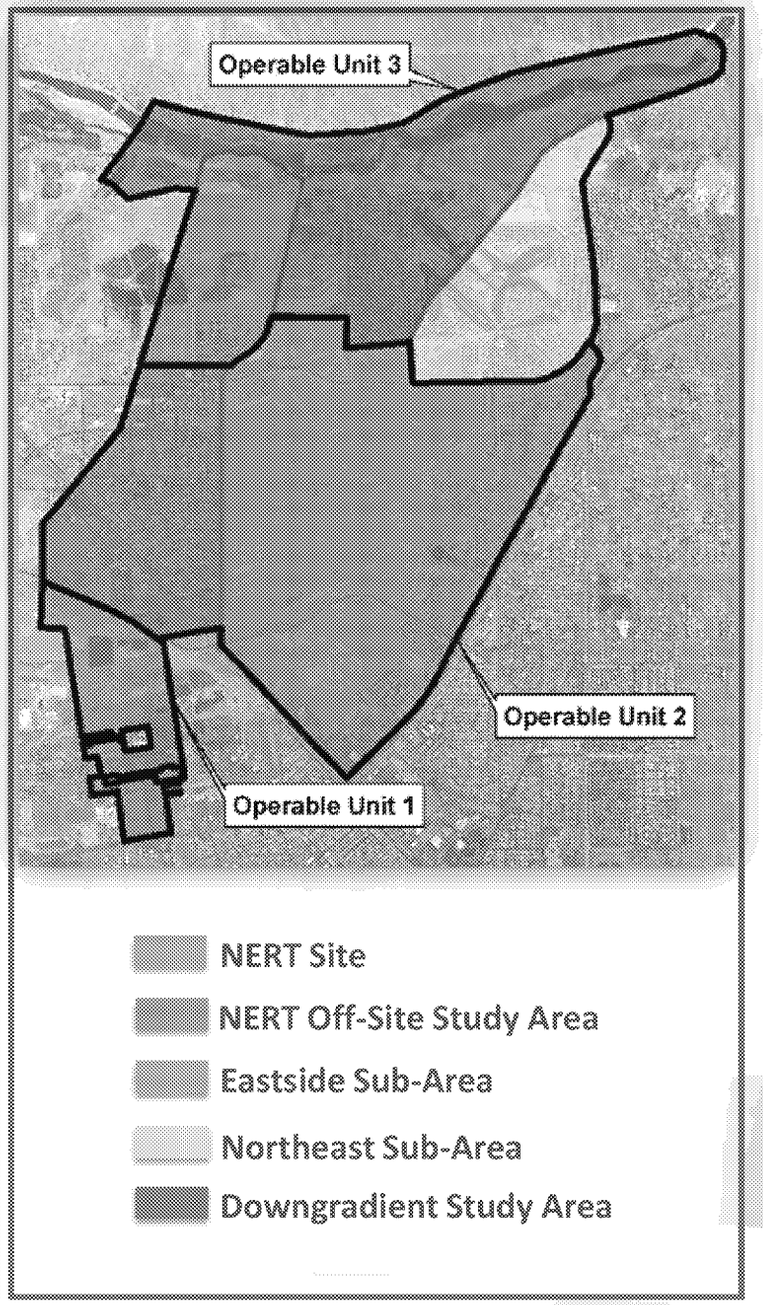
NERT Off-Site Study Area → OU-1

Eastside Sub-Area → OU-2

Northeast Sub-Area → OU-3

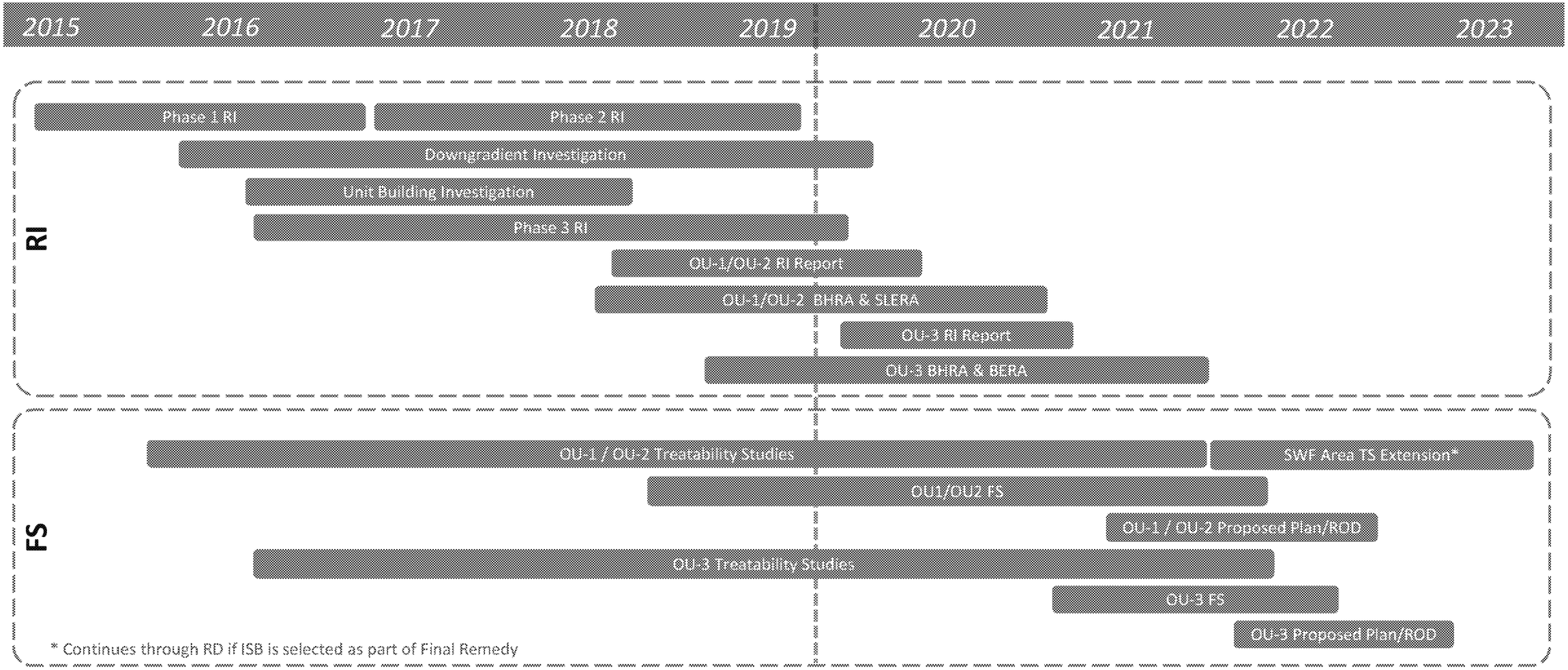
Downgradient Study Area

Entire NERT RI Study Area is approximately 5,250 acres (8.2 square miles) in size



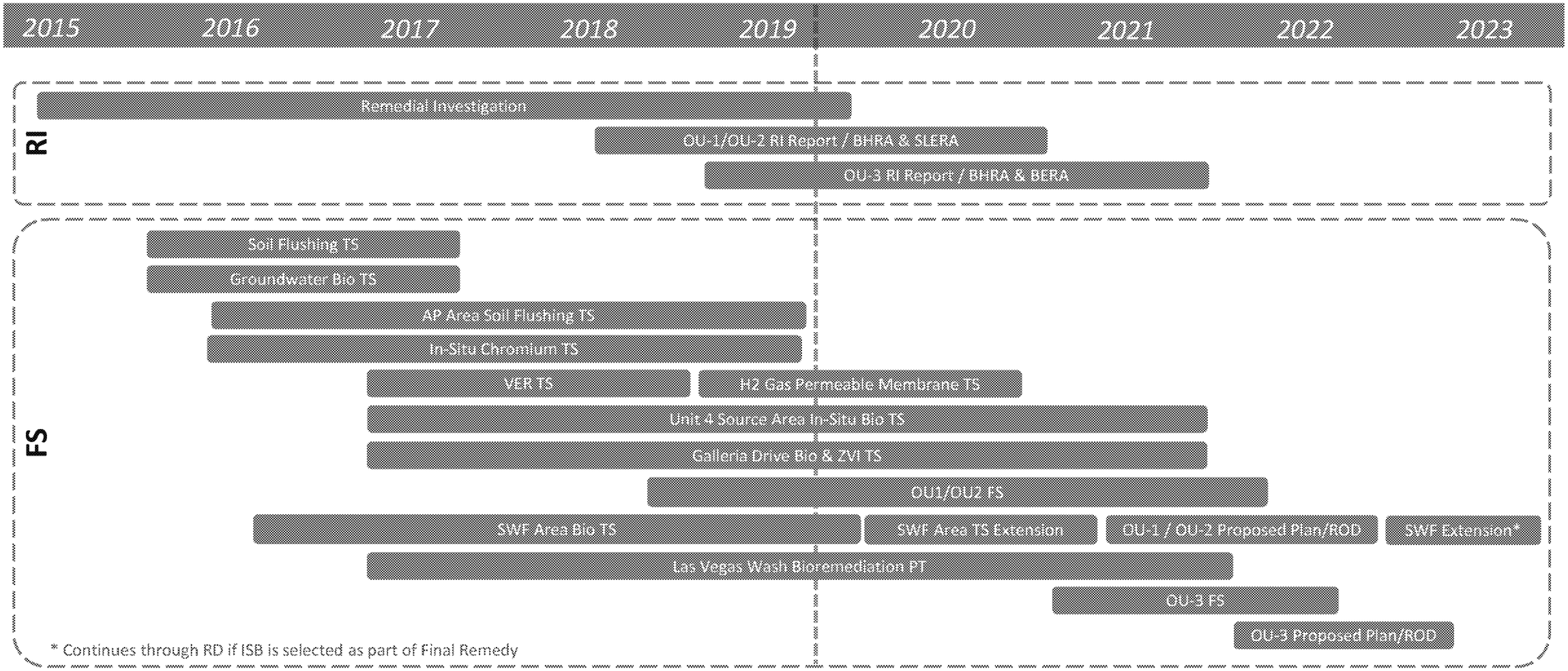
NERT REMEDIAL INVESTIGATION

REMEDIAL PROGRAM SUMMARY



NERT REMEDIAL INVESTIGATION

REMEDIAL PROGRAM SUMMARY

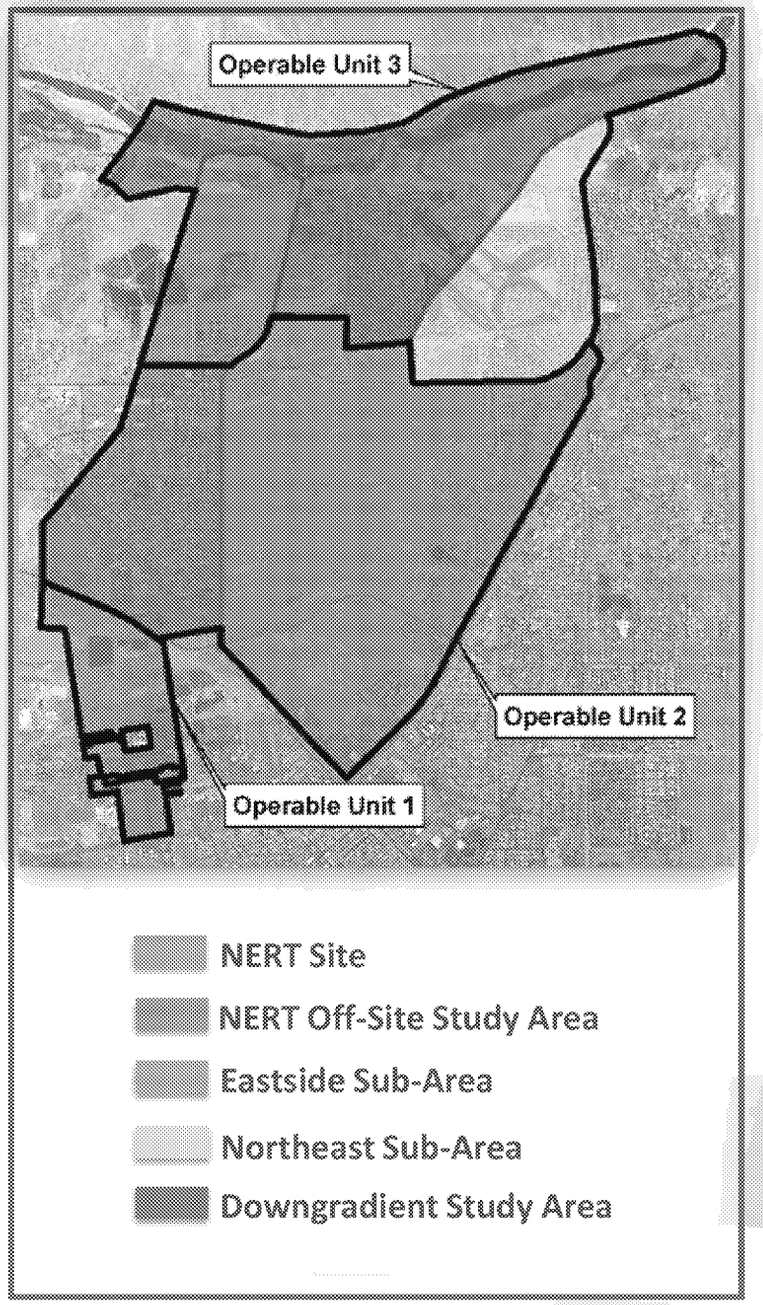


NERT REMEDIAL INVESTIGATION

REMEDIAL PROGRAM SUMMARY

Remedial Action Objectives (RAOs)

- Operable Unit (OU) strategy implemented in 2017 to expedite remedy implementation
- RAOs established for each OU
  - OU-1: Site Source Control and Containment
  - OU-2: Mid-Plume Containment and Mass Removal
  - OU-3: Mitigate Discharge to Las Vegas Wash



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OU-1 / OU-2 REMEDIAL INVESTIGATION STATUS

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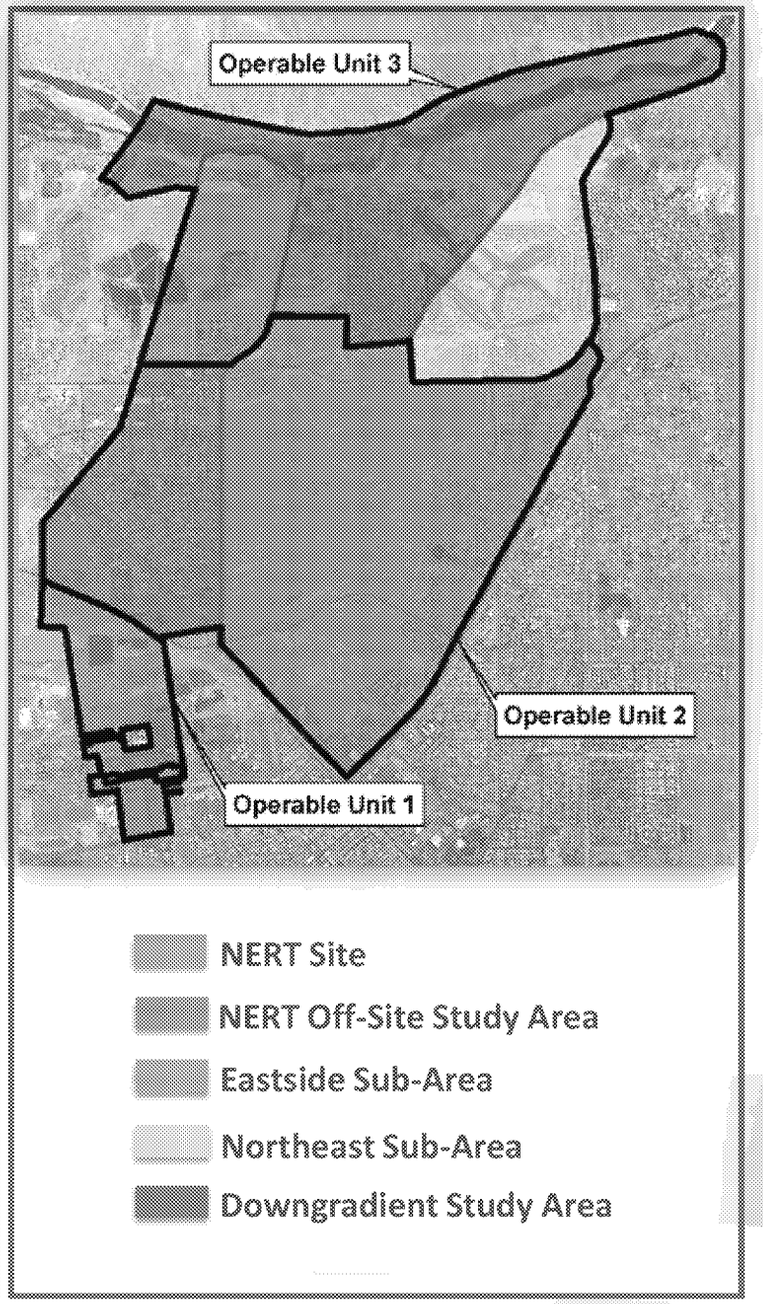
NERT REMEDIAL INVESTIGATION

OU-1 / OU-2 RI STATUS

- Field work complete
  - 40,000 feet (7.6 miles) of drilling
  - 292 soil borings
  - 178 monitoring wells installed
  - 4,485 soil samples analyzed
  - 1,129 groundwater samples analyzed
  - 77 soil gas samples analyzed
- RI Report preparation underway
- RI Report for OU-1 and OU-2 submittal planned for early June



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OU-1 / OU-2 CONCEPTUAL SITE MODEL

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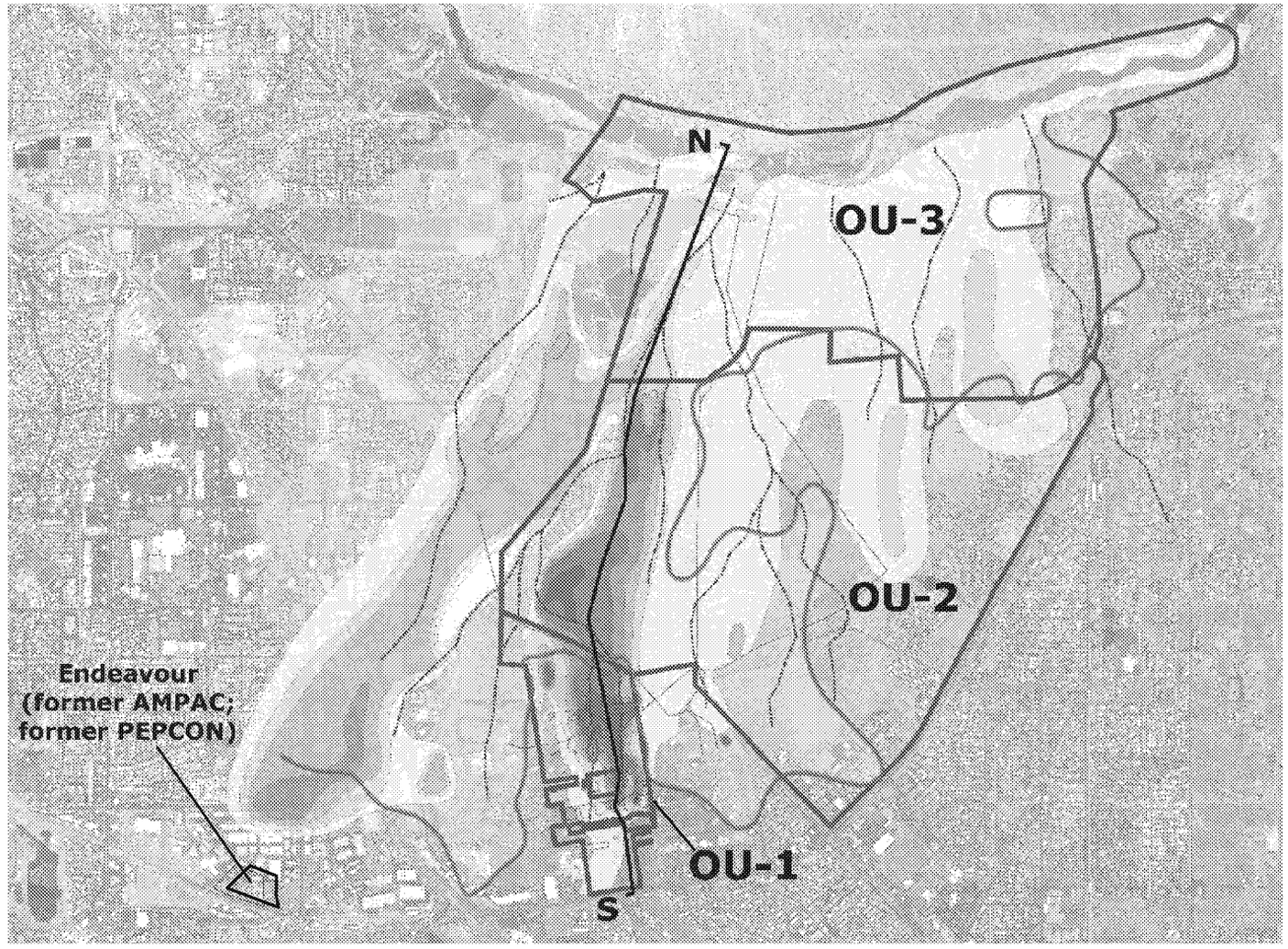
NERT REMEDIAL INVESTIGATION

OU-1/OU-2 CONCEPTUAL SITE MODEL



HORIZONTAL EXTENT OF PERCHLORATE CONTAMINATION

2018 Perchlorate Isoconcentration

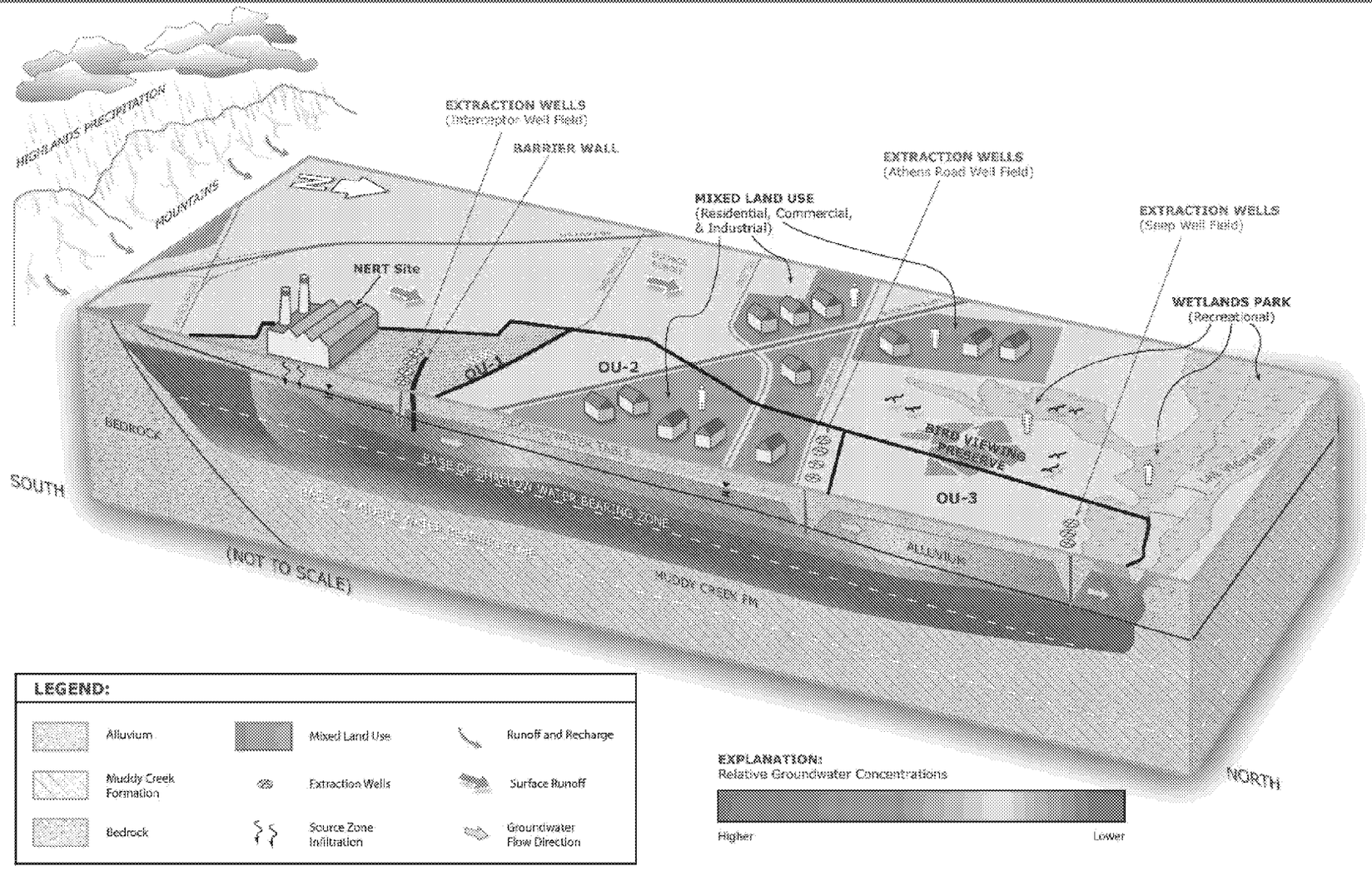
- <1 mg/L
- 1-10
- 10-25
- 25-100
- 100-250
- 250-500
- 500-1,000
- >1,000 mg/L

Other Features

- Approximate Location of Paleochannel Centerline
- Former Ditches
- Operable Unit Boundaries
- Saturated Alluvium
- Approximate Extent of Saturated Alluvium
- S—N South to North Subsurface Cross-Section Location

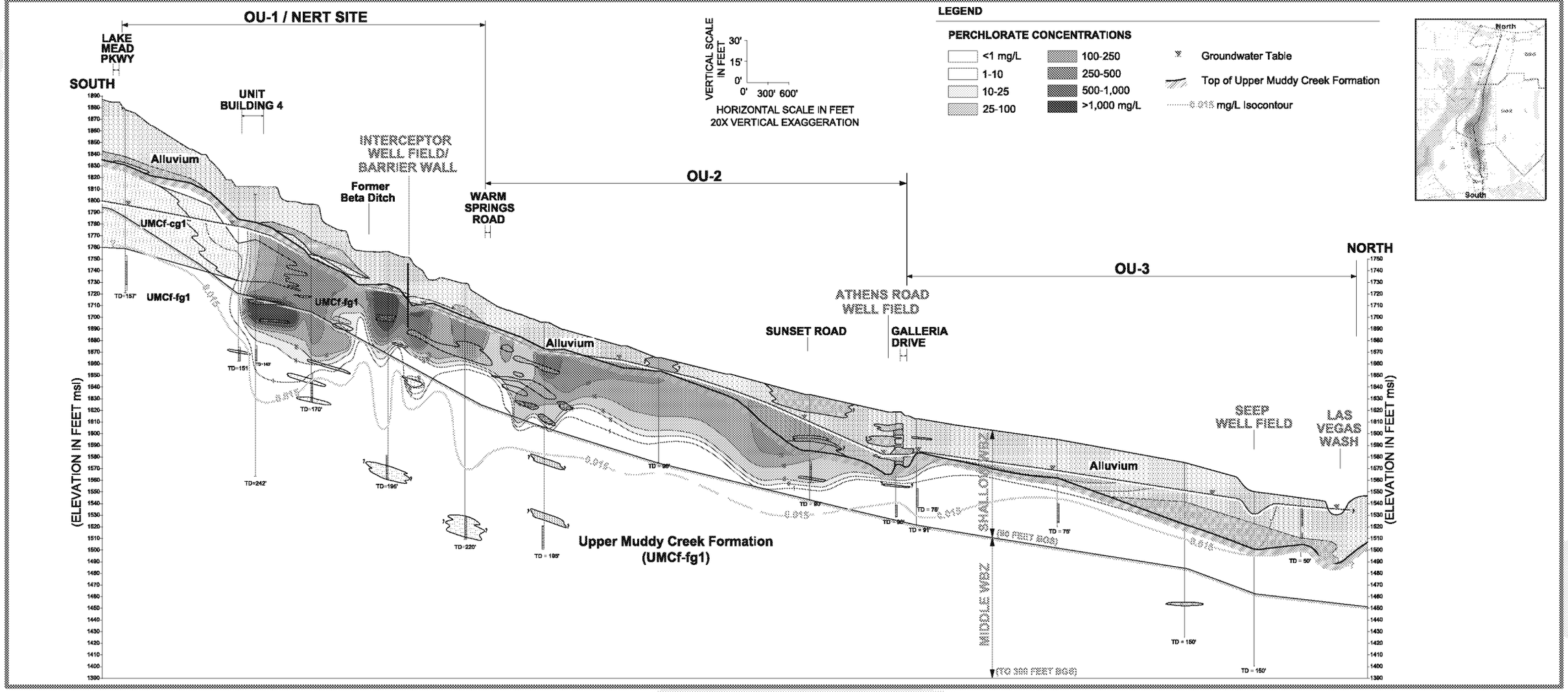
NERT REMEDIAL INVESTIGATION

OU-1/OU-2 CONCEPTUAL SITE MODEL



NERT REMEDIAL INVESTIGATION

OU-1 / OU-2 CONCEPTUAL SITE MODEL



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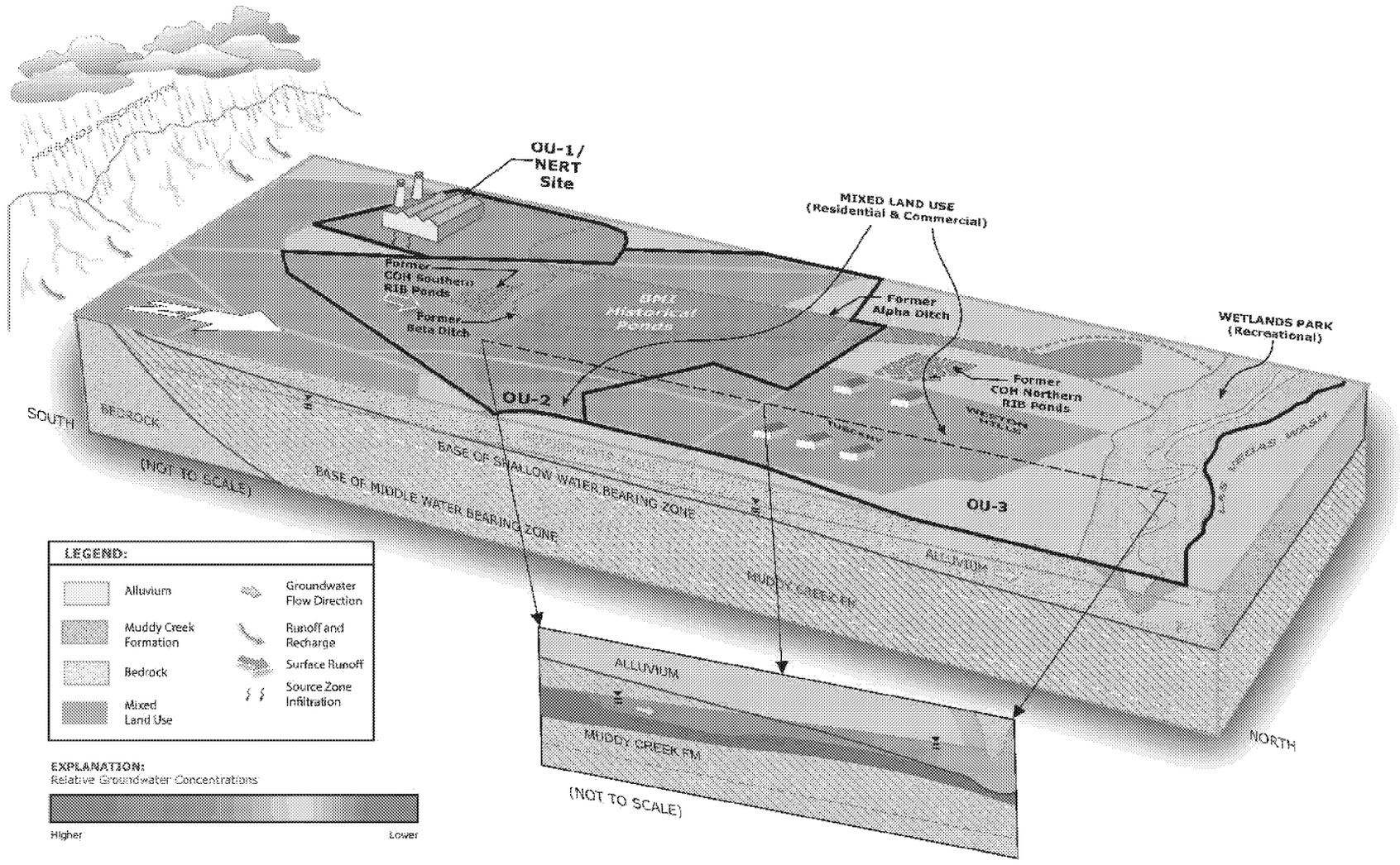

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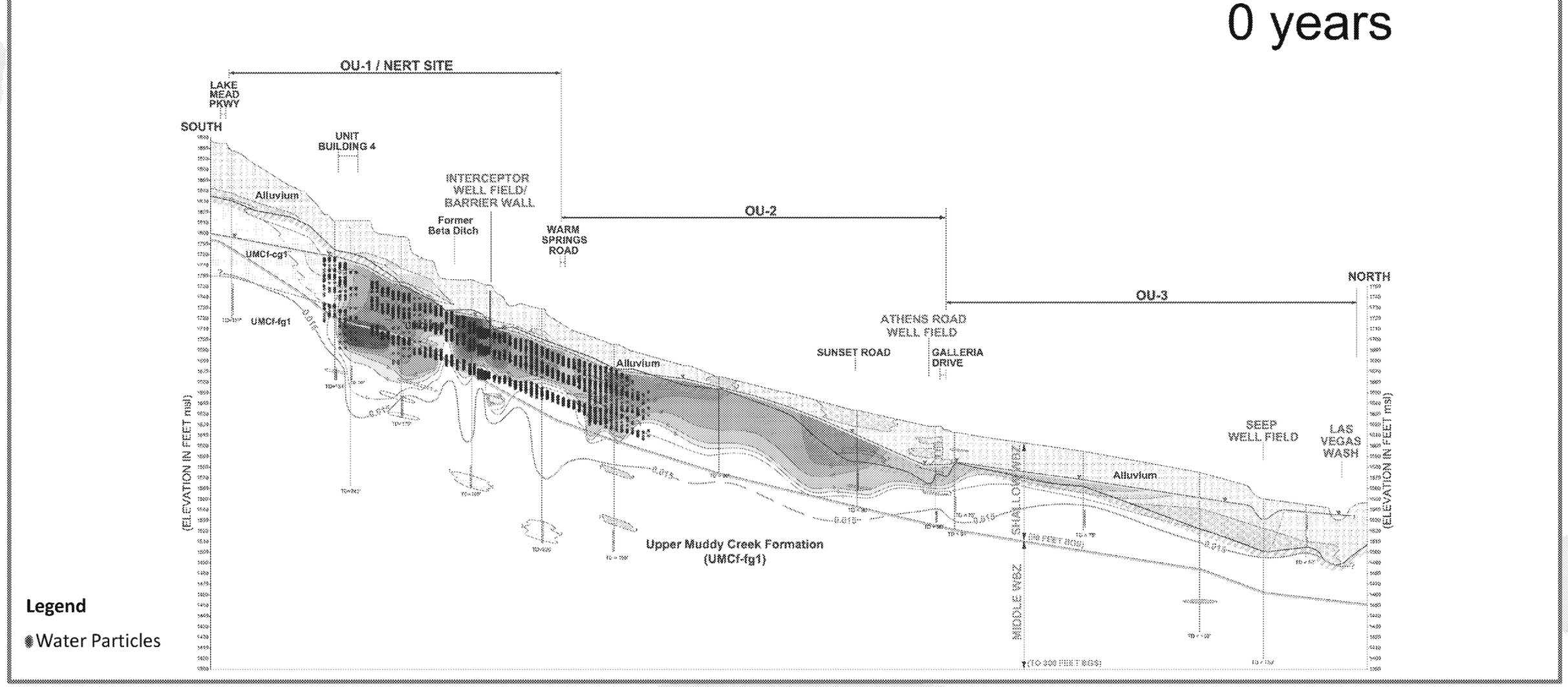

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OU-3 REMEDIAL INVESTIGATION STATUS

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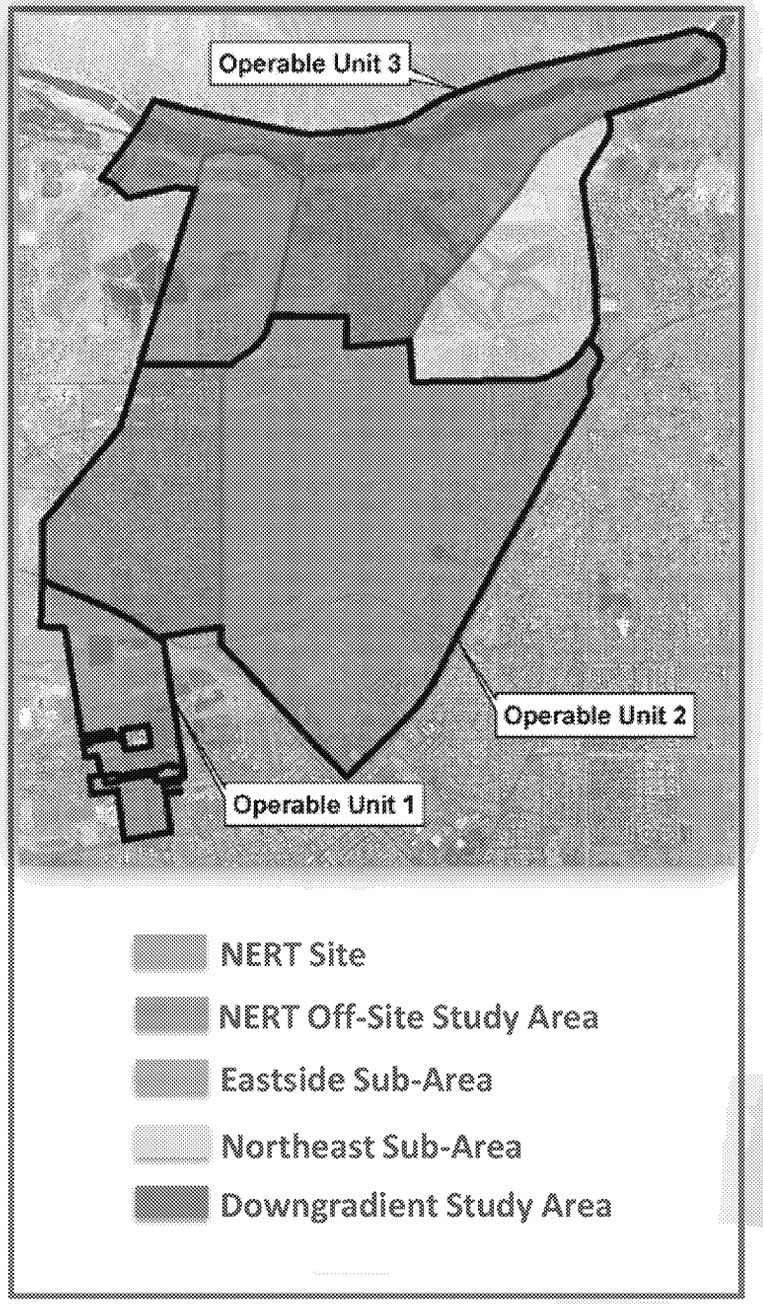
NERT REMEDIAL INVESTIGATION

OU-3 RI STATUS

- Upcoming field work includes:
  - Phase 2 groundwater investigation in Downgradient Study Area
  - Investigation of paleochannel migration pathway north of Tuscany Village community (Phase 3 RI Modification 4)
  - Investigation of vertical extent of perchlorate along LVW adjacent to SWF (Phase 3 RI Modification 5)
  - Soil gas investigation in NERT Off-Site Study Area between AWF and SWF
- RI Report for OU-3 planned for submittal in May 2020



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DOWNGRADIENT INVESTIGATION STATUS

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REMEDIAL INVESTIGATION PATH FORWARD

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

NERT REMEDIAL INVESTIGATION

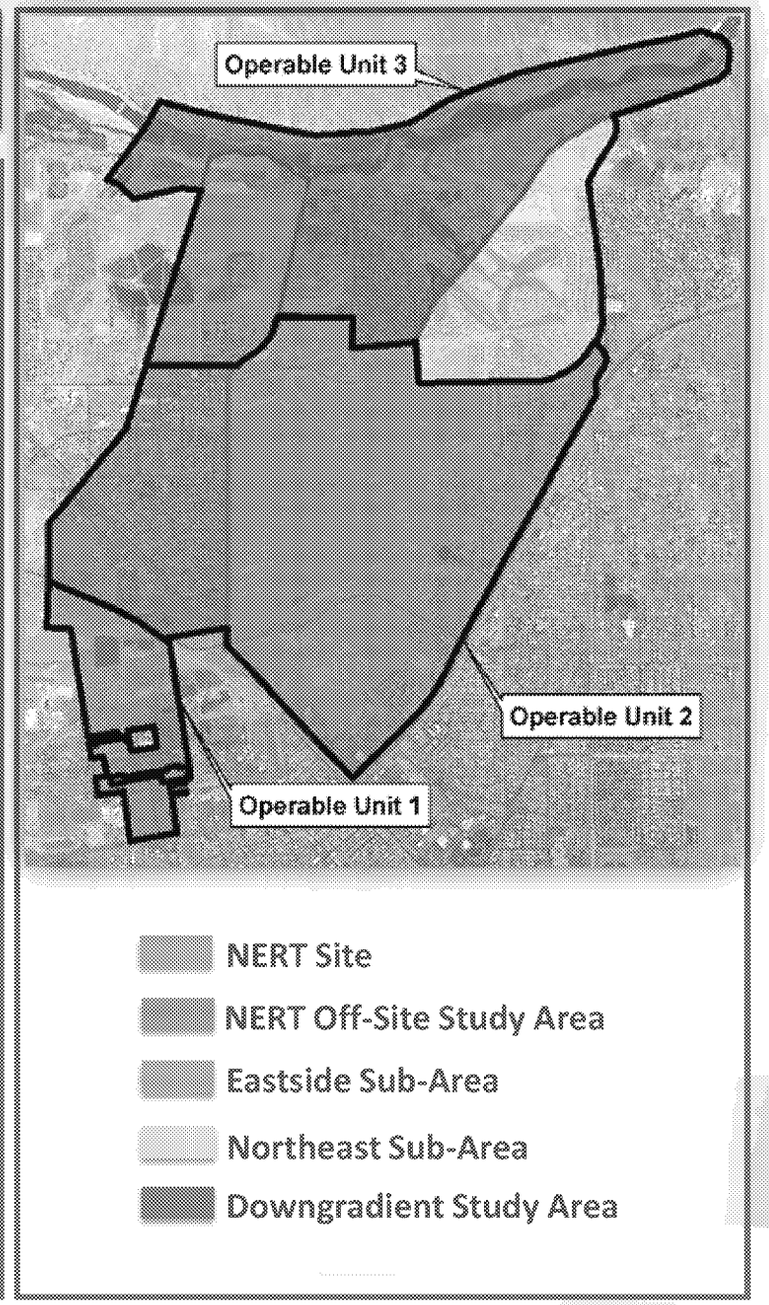
UPCOMING RI DELIVERABLES

2nd Quarter

- Semi-Annual Remedial Performance Memorandum
- OU-3 BHRA Work Plan
- Remedial Investigation Report for OU-1 and OU-2

3rd Quarter

- OU-1 Soil BHRA Report
- OU-1 and OU-2 SLERA Reports

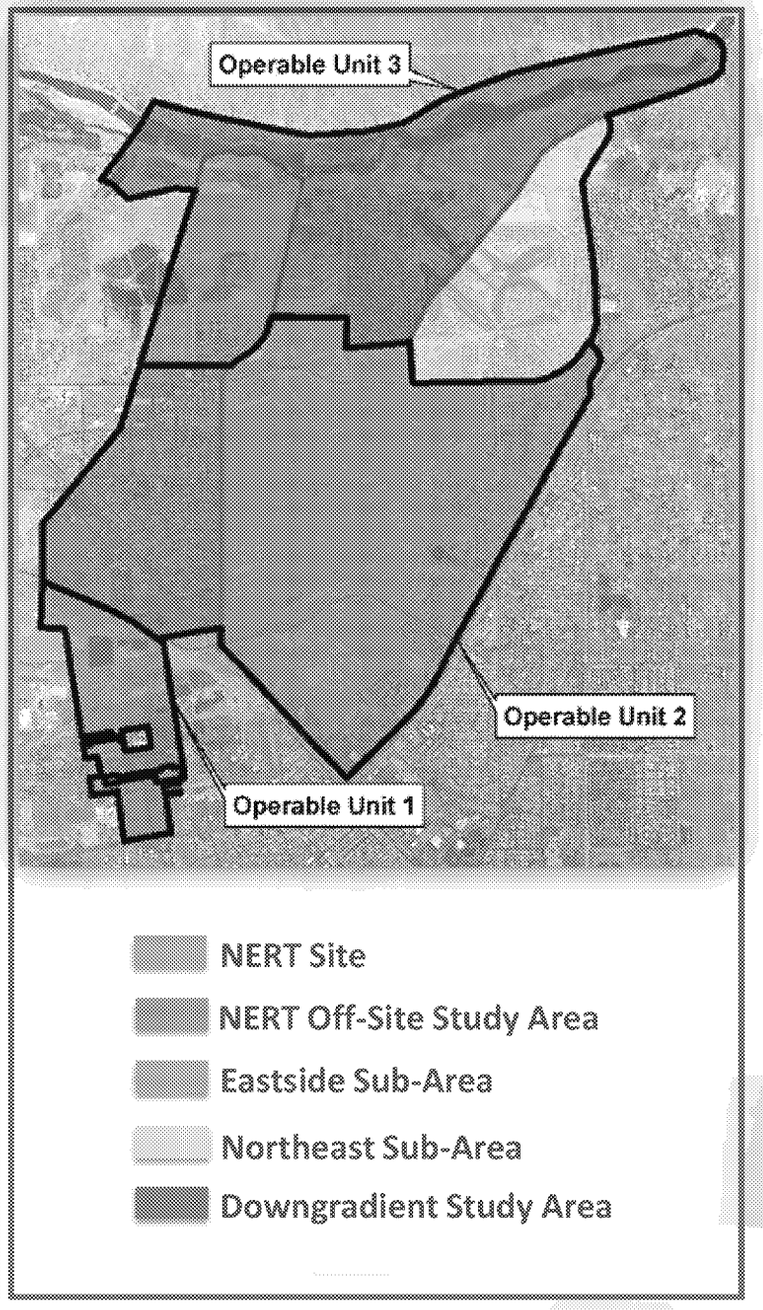


NERT REMEDIAL INVESTIGATION

UPCOMING RI DELIVERABLES

4th Quarter

- Annual Remedial Performance Report
- Phase 6 Groundwater Model
- OU-1 and OU-2 Soil Gas and Groundwater BHRA Reports
- Parcel E HRA Report



NEVADA ENVIRONMENTAL RESPONSE TRUST

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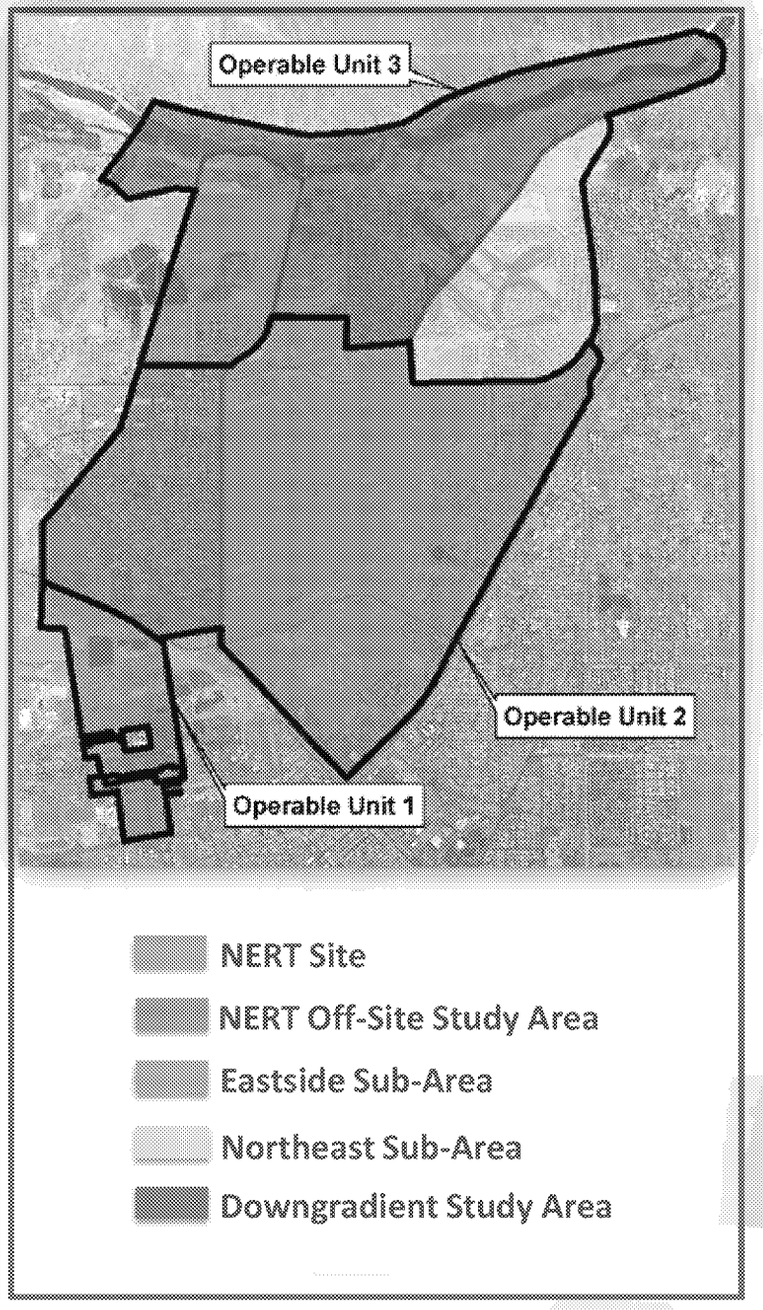
NERT FEASIBILITY STUDY

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

NERT FEASIBILITY STUDY

OVERVIEW OF ONGOING STUDIES

- The Feasibility Study (FS) is the mechanism for the development, screening, and detailed evaluation of remedial action alternatives
- Detailed remedial action alternatives will be developed that are designed to achieve the remedial action objectives developed during the Phase 3 RI Work Plan process
- The FS will include detailed pre-design cost estimates (+50%/-30%) for each remedial action alternative



NERT FEASIBILITY STUDY

PURPOSE OF TREATABILITY/PILOT STUDIES

- Treatability/Pilot Studies provide valuable, site-specific data necessary to evaluate and support remedy selection during the Feasibility Study and determine whether or not a given technology can meet the remedial objective, in this case an OU specific RAO
- Key differences between a Treatability Study and Pilot Study:
  - A Treatability Study will involve characterizing impacted media and evaluate the performance of the technology under various operating conditions and simulations
    - Bench scale (laboratory) and/or field testing
    - Generally less expensive/shorter duration than a Pilot Study
    - May be qualitative and/or quantitative, but generally qualitative in terms of demonstrating contaminant reduction

NERT FEASIBILITY STUDY

PURPOSE OF TREATABILITY/PILOT STUDIES

- A Pilot Study is used to provide quantitative performance, cost and technology specific design information
  - Utilize actual media (soil/groundwater) impacted with site specific COC's
  - Generally more expensive/longer duration than a Treatability Study
  - Simulate the operation of the full scale treatment process
  - May be qualitative and/or quantitative, but generally quantitative in terms of contaminant reduction

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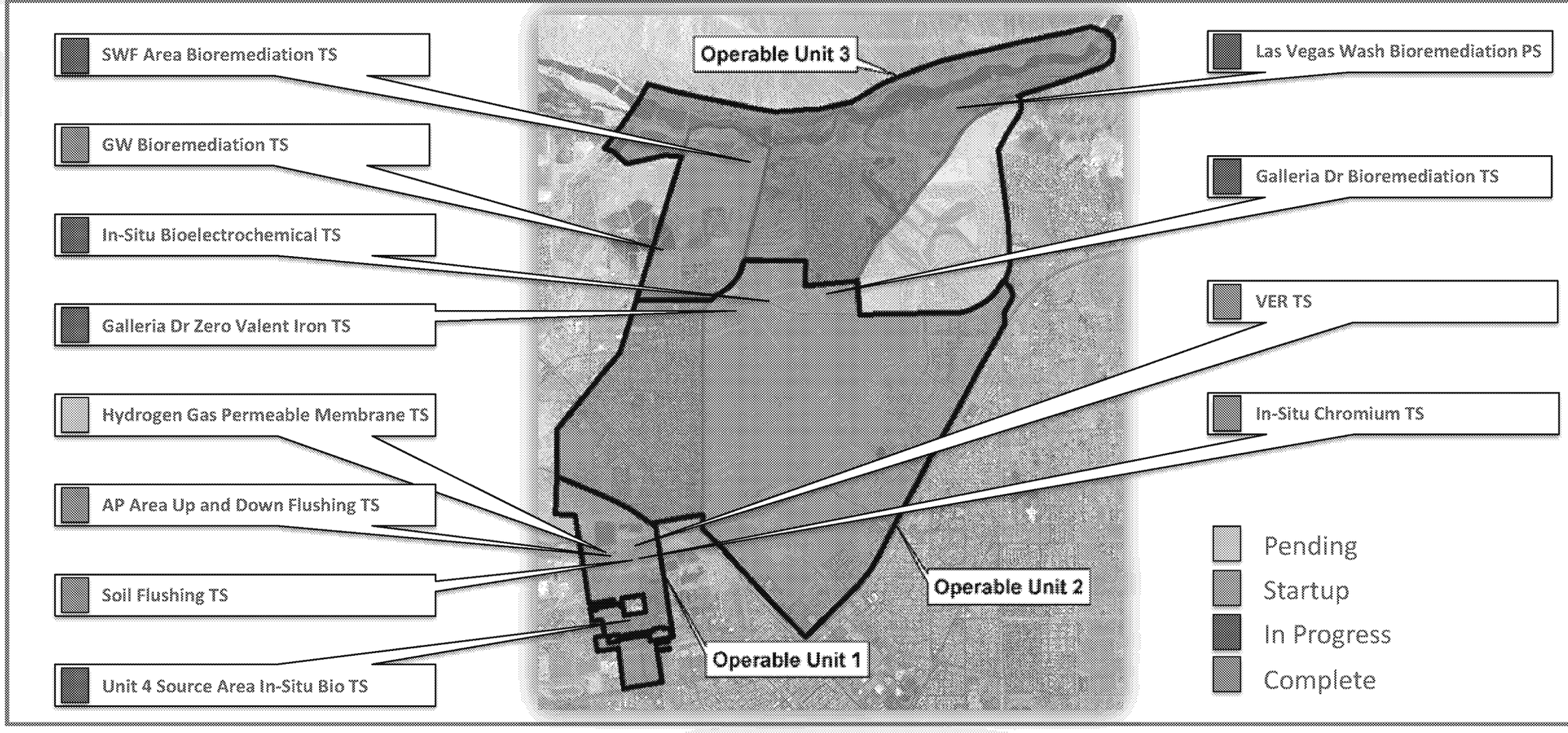
OVERVIEW OF TREATABILITY STUDIES

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

NERT FEASIBILITY STUDY

OVERVIEW OF TREATABILITY STUDIES



NEVADA ENVIRONMENTAL RESPONSE TRUST

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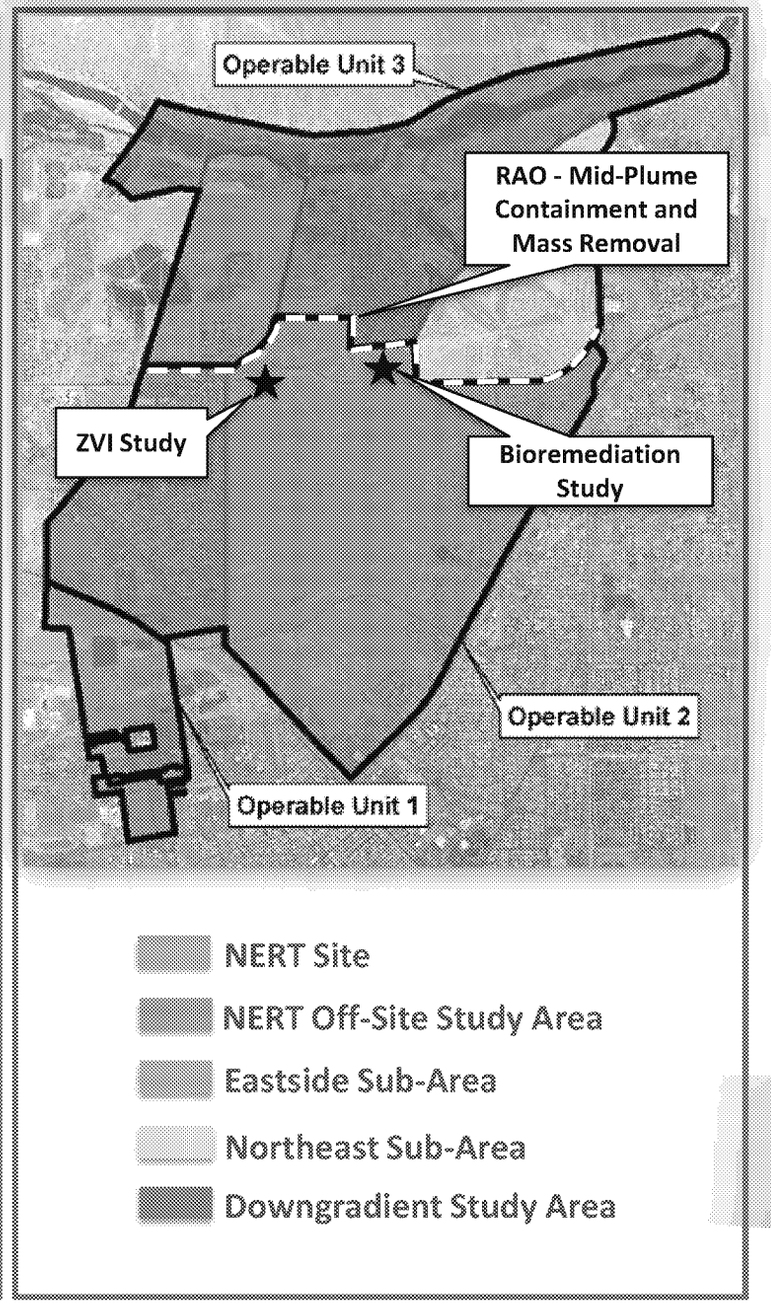
UNLV BENCH SCALE STUDIES

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

OVERVIEW OF TREATABILITY STUDIES

GALLERIA DRIVE BIOREMEDIATION

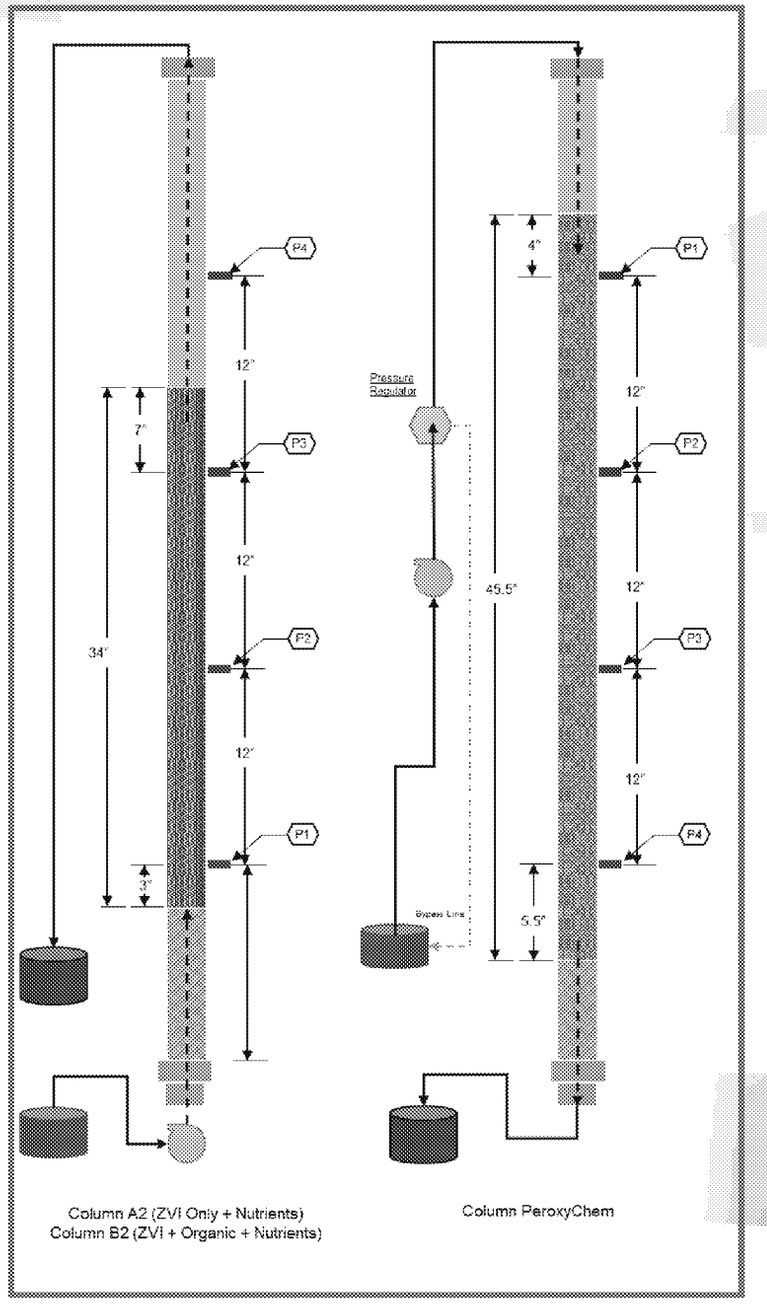
- Objective – design and implement a treatability study to evaluate the effectiveness of in-situ bioremediation in the Upper Muddy Creek formation (UMCf) within OU-2
- Companion study to ZVI; both of which are along Galleria Dr
- Provides essential input to Key RAO of Mid-Plume Containment and Mass Removal
- Phase 1 Completed; Work Plan Addendum Submitted
- Study will focus treatment on upper portion of the UMCf where perchlorate concentrations in groundwater are as high as 14,000 µg/L
- Treatability Study will begin in Q2 2019 and anticipated to be completed in Q4 2020



OVERVIEW OF TREATABILITY STUDIES

GALLERIA DRIVE ZVI-ENHANCED BIOREMEDIATION

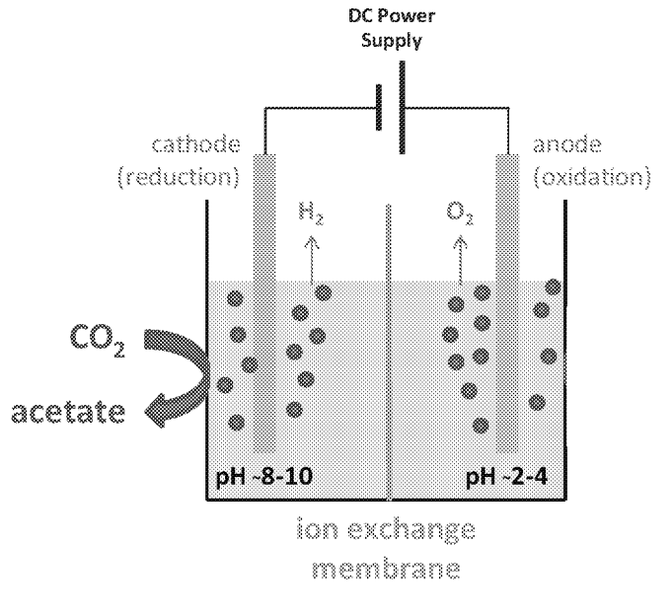
- Objective - evaluate applicability of granular ZVI to remove chlorate and nitrate from site groundwater while stimulating biological perchlorate reduction
- Phase 1 field investigation completed April-May 2018
- Treatability Study Mod 5 to evaluate potential deeper contamination completed in January 2019 (data pending)
- Bench-scale study being performed at UNLV (ongoing)
  - ZVI rapidly and completely removes chlorate and nitrate from site groundwater
  - Biological perchlorate reduction is stimulated using ZVI under certain conditions
- Stakeholder Roundtable and Work Plan Addendum - Q2 2019

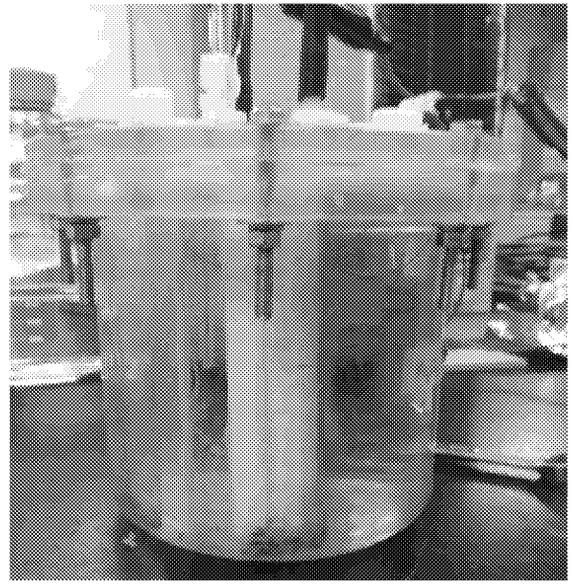


OVERVIEW OF TREATABILITY STUDIES

IN-SITU BIOELECTROCHEMICAL

- Objective - evaluate electrochemical methods for in-situ biological reduction of perchlorate and chlorate in groundwater
- Bench-scale testing is being performed at Colorado State University (CSU)
  - Microcosm testing demonstrates that chlorate, perchlorate, and nitrate are completely removed
  - Batch reactor testing demonstrates generation of acetate / other organic electron donors and the electron donors are utilized by perchlorate-reducing bacteria
  - Column testing is underway to evaluate two potential applications of bioelectrochemical treatment
- Stakeholder Roundtable and Work Plan Addendum – Q3 2019



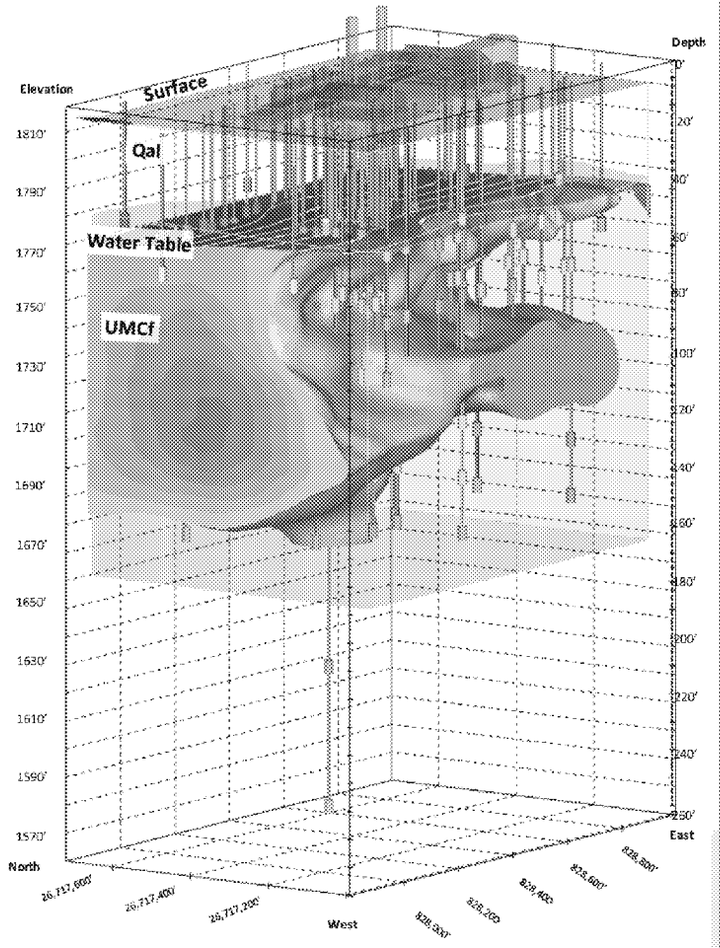


OVERVIEW OF TREATABILITY STUDIES

UNIT 4 SOURCE AREA IN-SITU BIOREMEDIATION

- Objective – Evaluate effectiveness of a hybrid ISB/GW extraction approach to remediate high concentration COPCs
- Bench scale testing has generated some interesting results
  - Molasses tests have shown successful degradation of hexavalent chromium, nitrate, and chlorate; monitoring for perchlorate reduction is ongoing
  - EOS and acetate tests have shown successful degradation of hexavalent chromium, nitrate, chlorate, and perchlorate
  - Nano ZVI testing has shown rapid degradation of hexavalent chromium but monitoring for nitrate, chlorate, and perchlorate reduction is still ongoing

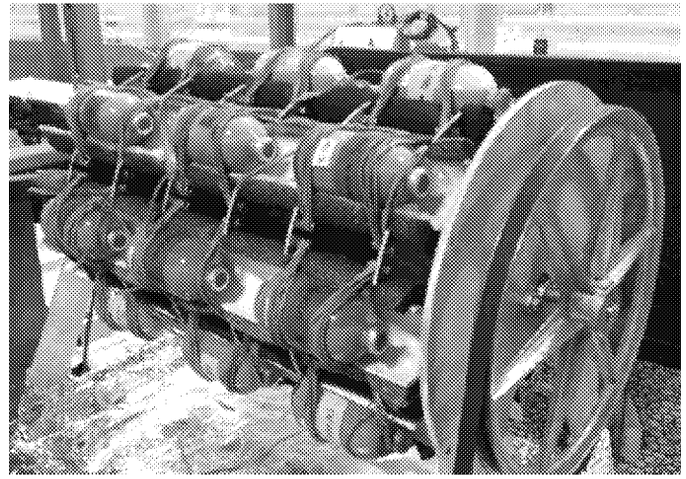
Perchlorate in groundwater > 10 mg/L

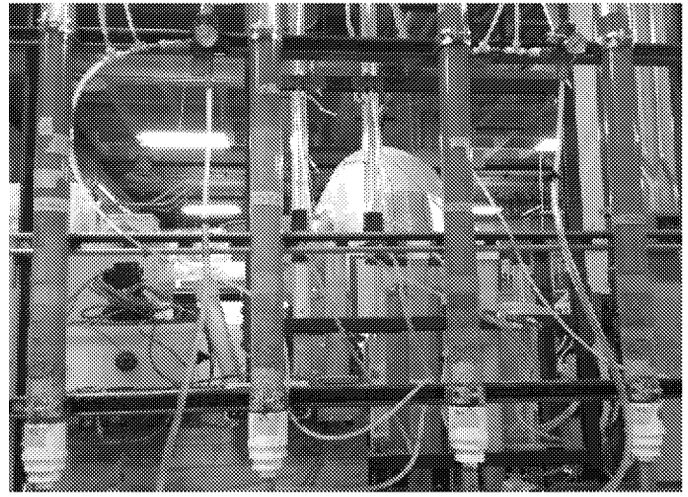


OVERVIEW OF TREATABILITY STUDIES

UNIT 4 SOURCE AREA IN-SITU BIOREMEDIATION

- Bench scale testing (Continued)
  - Bench scale testing indicates that TDS concentrations above 20,000 mg/L inhibits in-situ bioremediation
- Completion of the microcosm and column tests will be critical in selection of the treatment amendments
- Given that high TDS (> 21,000 mg/L) appears to inhibit in-situ bioremediation of COPCs, a groundwater extraction test was conducted to determine if limited duration pumping could lower the TDS concentrations at the northwest corner of the Unit 4 basement



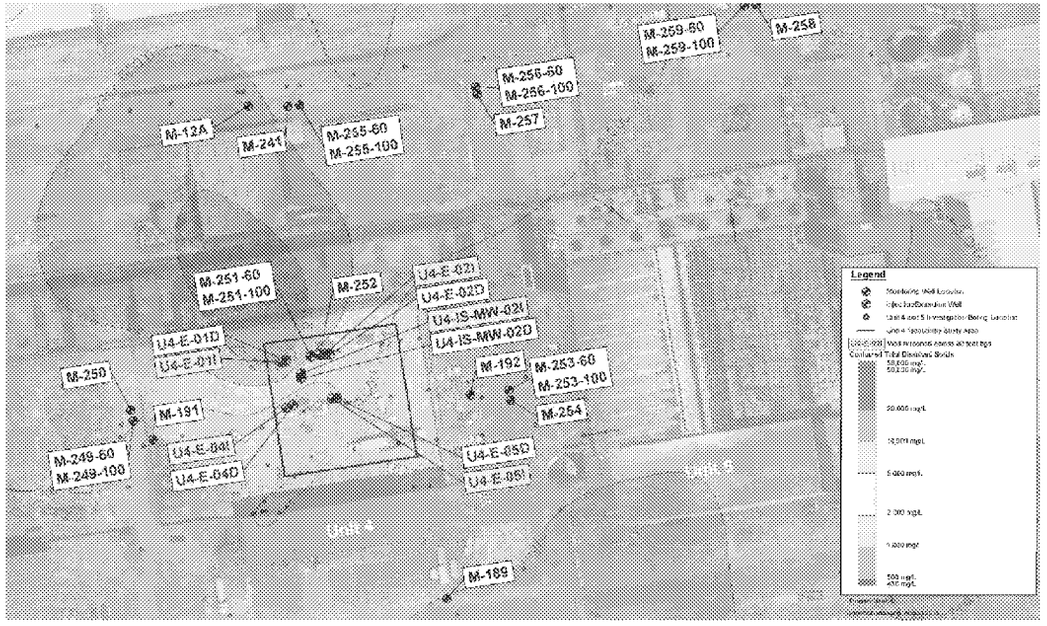


OVERVIEW OF TREATABILITY STUDIES

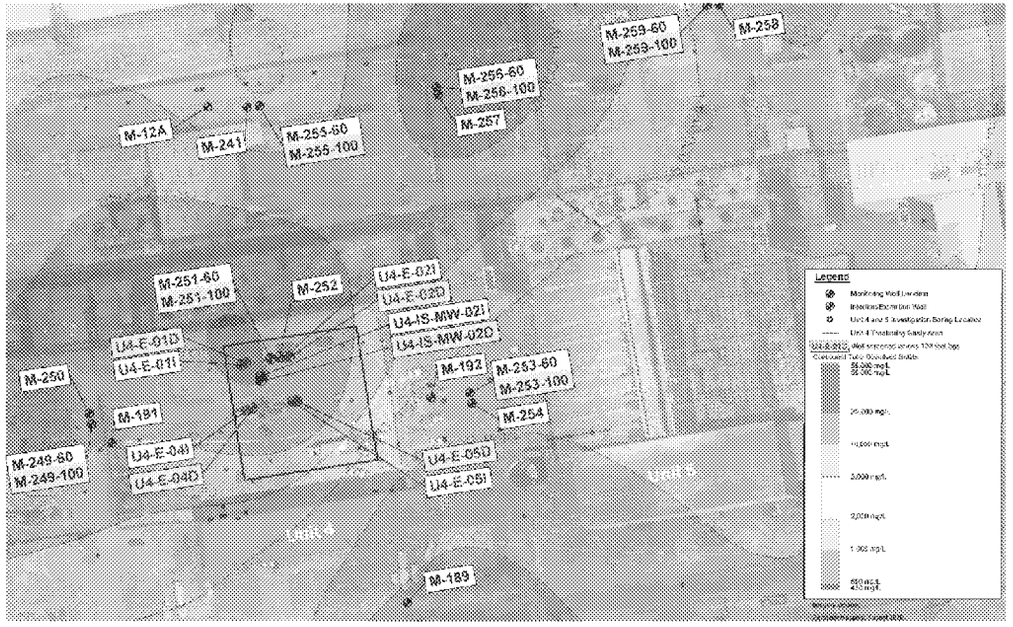
UNIT 4 SOURCE AREA IN-SITU BIOREMEDIATION

- Preliminary results indicate that groundwater within the 75 – 90 ft bgs interval containing 31,000 mg/L was reduced to less than 5,000 mg/L
- Preliminary results indicate that TDS concentrations in the 95 – 110 ft bgs interval decreased from ~40,000 mg/L to 28,000 mg/L over the 3 month extraction test

Intermediate zone (75-90 ft bgs)



Deep zone (75-90 ft bgs)



OVERVIEW OF TREATABILITY STUDIES

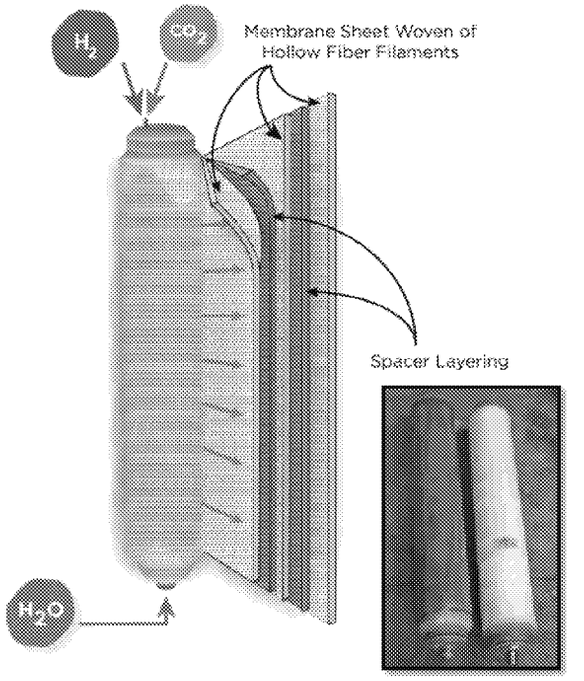
UNIT 4 SOURCE AREA IN-SITU BIOREMEDIATION

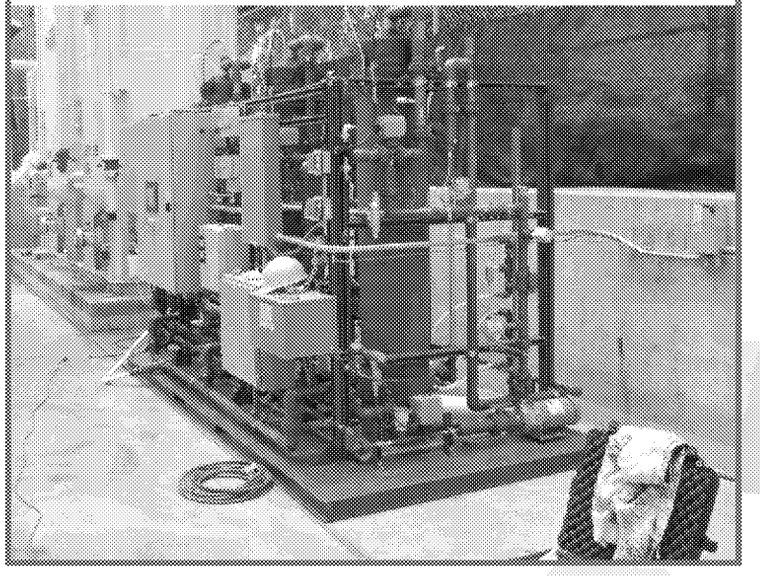
- Next steps:
  - Complete microcosm and column studies and select treatment amendments
  - Determine best pulsed injection/extraction strategy to implement in-situ bioremediation in the 95 -110 ft bgs interval
  - Design pipeline to convey water during extraction periods to the GWETS system
  - Stakeholder Technical Roundtable in Q2
  - Submit Treatability Study Work Plan Addendum in Q2

OVERVIEW OF TREATABILITY STUDIES

HYDROGEN GAS PERMEABLE MEMBRANE

- Objective - to evaluate the ability of a proprietary hollow-fiber membrane biofilm reactor (MBfR) to reduce perchlorate
- The system uses H_2 in lieu of ethanol or acetic acid typically used in FBR systems. H_2 from on-site generator continuously metered into hollow-fiber systems within reactors
- Work Plan submitted on 2/15
- Next Steps:
  - Design and implement modifications to the existing pilot unit and on-site components
  - Install, start-up, and operate the pilot unit under three test scenarios



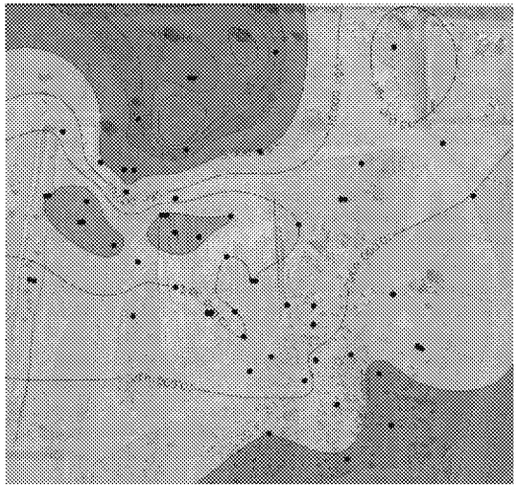


OVERVIEW OF TREATABILITY STUDIES

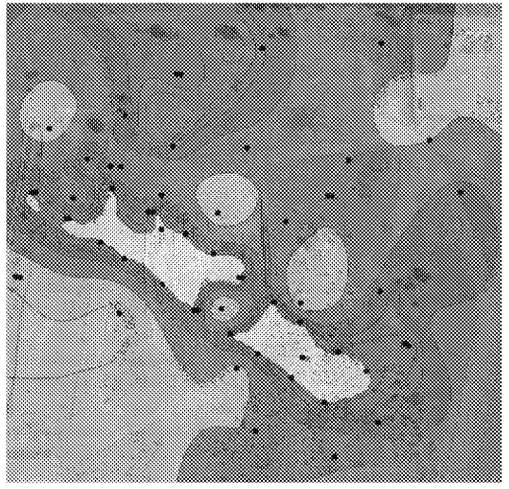
SEEP WELL FIELD AREA BIOREMEDIATION

- Objective - implement a treatability study to evaluate the effectiveness of in-situ bioremediation to reduce perchlorate concentrations in groundwater within the alluvium to concentrations below the current NDEP action level
- Treatability Study continues to show success at reducing perchlorate concentrations in groundwater by 80% and maintaining perchlorate concentrations below 18 ug/L within the treatment zone

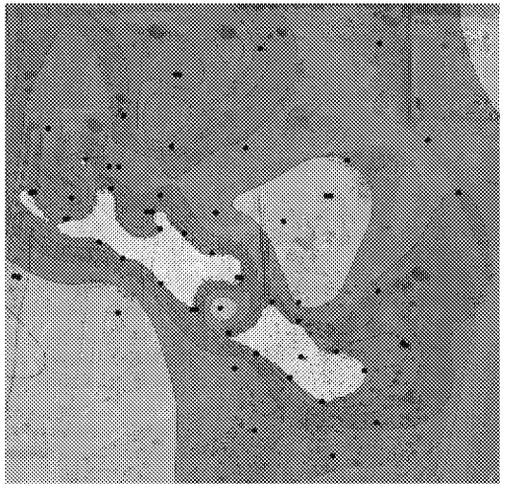
July 2017 (Baseline)



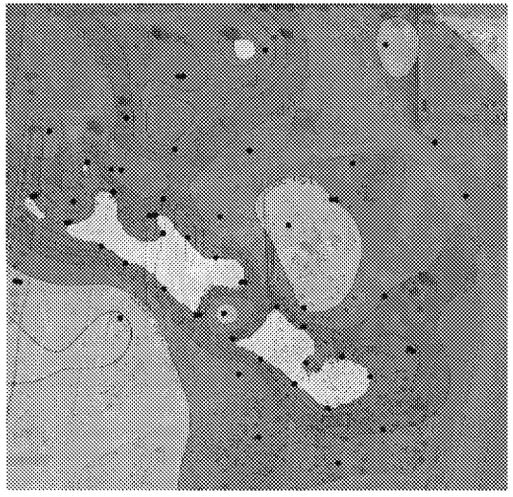
July 2018



August 2018



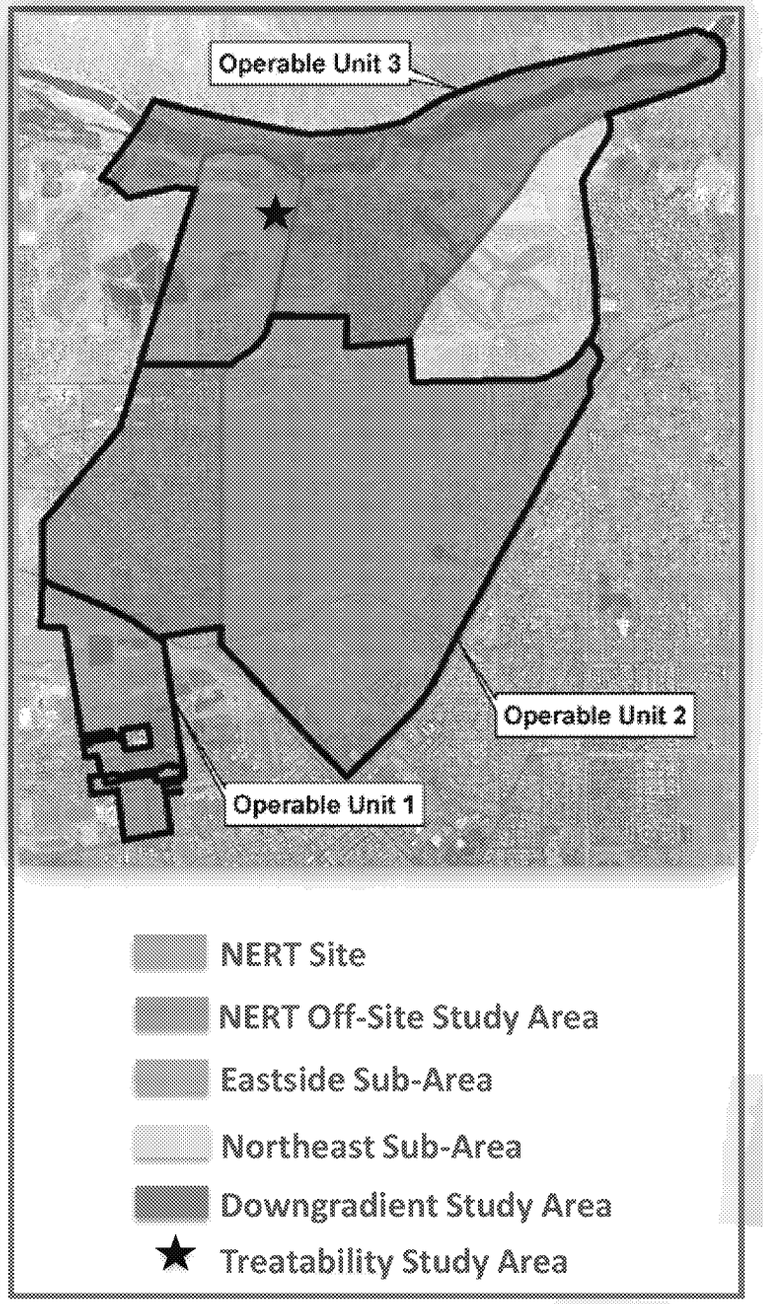
September 2018



OVERVIEW OF TREATABILITY STUDIES

SEEP WELL FIELD AREA BIOREMEDIATION MODIFICATION

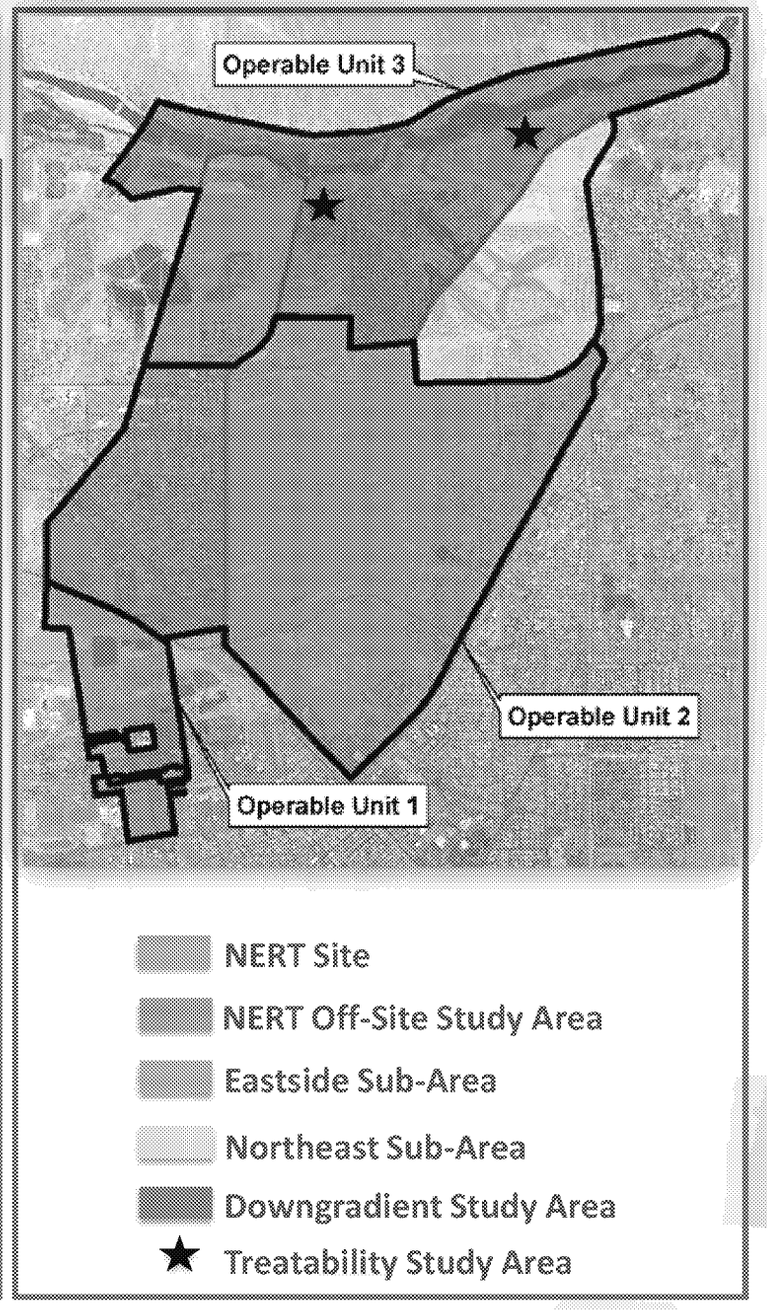
- Recently extended as part of a modification, with fourth injection event completed in February 2019
- Extension will evaluate the following:
  - Injection frequencies and substrate quantities to arrive at optimal dosing and variations for full-scale application
  - Injection well operation and maintenance techniques (injection well rehabilitation and corrective measures)
- Continuation through design of final remedy



OVERVIEW OF TREATABILITY STUDIES

LAS VEGAS WASH BIOREMEDIATION

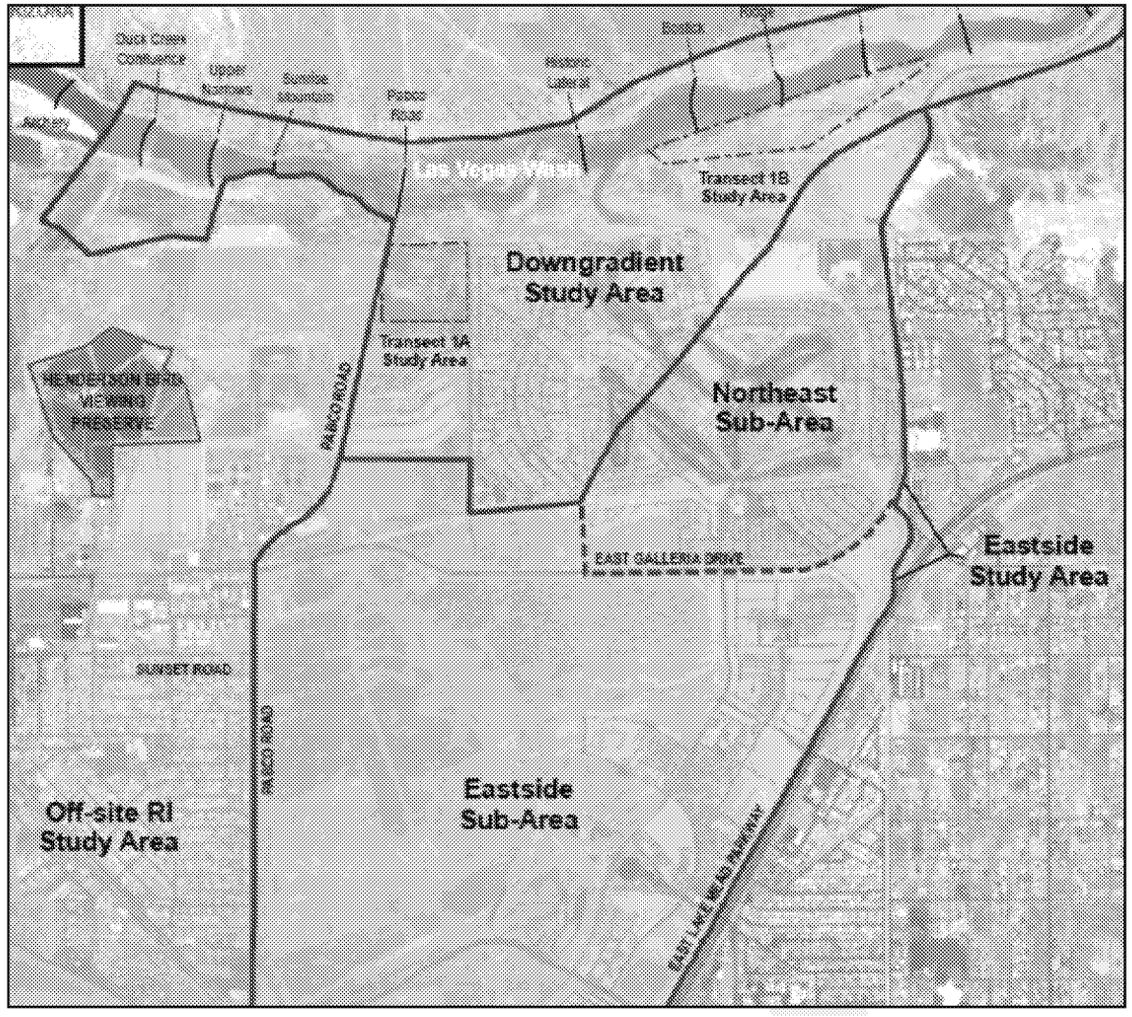
- Objective – design and implement a pilot study to evaluate the effectiveness of in-situ bioremediation in a geologically complex area so that perchlorate concentrations in groundwater are generally reduced below 18 ug/L
- Provide essential input to the Feasibility Study to evaluate design, optimization/scale-up, and cost effectiveness
- Phase 1 pre-design field investigation completed March-July 2018
- Treatability/Pilot Study Mod 2 to evaluate potential deeper contamination and further define the extent of paleochannels completed in January 2019
- Bench-scale study being performed at UNLV (ongoing)



LAS VEGAS WASH BIOREMEDIATION PILOT STUDY

PILOT STUDY AREAS

- Two separate study areas
- Transect 1a Study Area –
  - East of Pabco Road on City of Henderson Property
  - Perchlorate concentrations up to 9,400 µg/L
- Transect 1b Study Area –
  - Immediately upgradient of Calico Ridge Weir on Clark County property
  - Perchlorate concentrations up to 16,000 µg/L
  - Area of increased perchlorate mass flux to the Las Vegas Wash



OVERVIEW OF TREATABILITY STUDIES

LAS VEGAS WASH BIOREMEDIATION

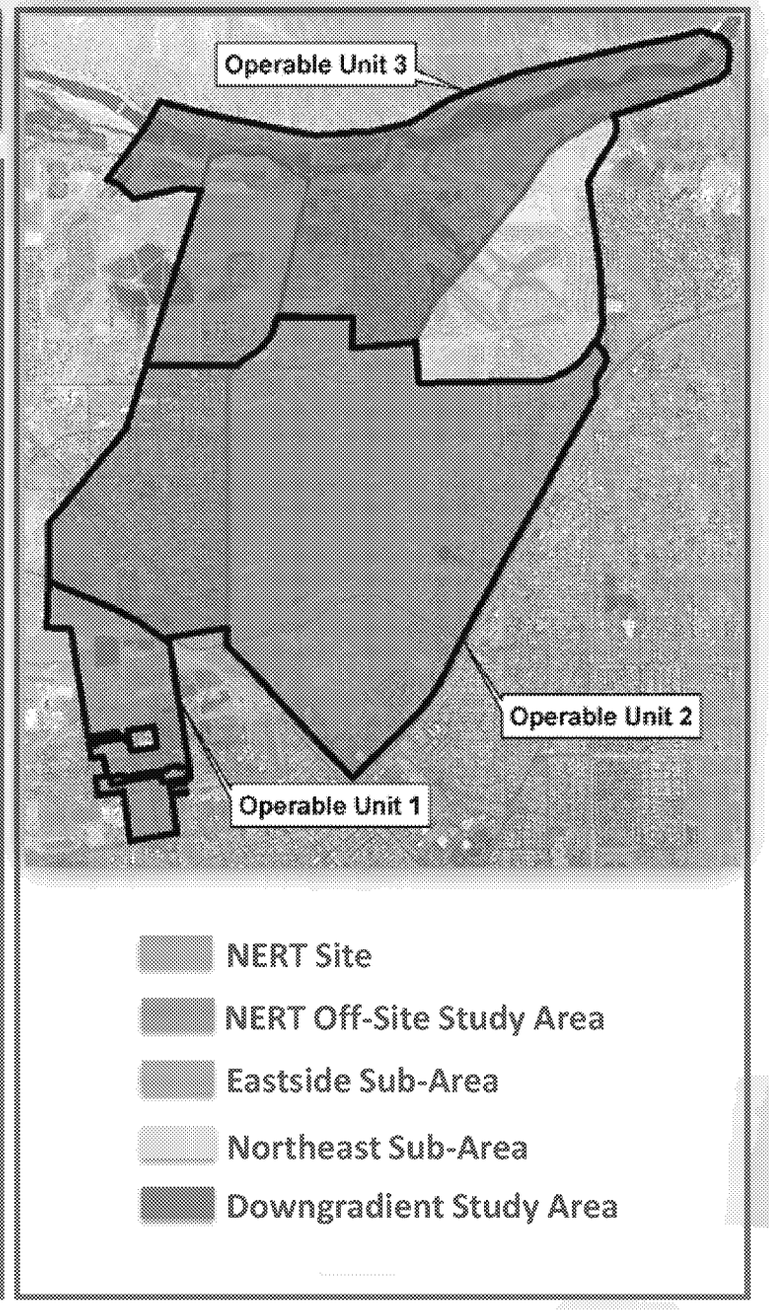
- Next steps:
  - Complete microcosm and column studies and select treatment amendments
  - Third-party Cost Review – Q1 2019
  - Stakeholder Technical Roundtable in Q2 2019
  - Work Plan Addendum submitted to NDEP/Stakeholders – Q2 2019
  - Field implementation of pilot study to begin following agency approval

NERT FEASIBILITY STUDY

POTENTIAL STUDIES UNDER CONSIDERATION

New 2019 Studies Under Consideration

- In-Situ ZVI Emplacement Applications
  - OU-1 Northern Boundary
    - Continuous Trench or Well Application
    - Funnel & Gate Application
  - OU-3 near the Las Vegas Wash
    - Continuous Trench or Well Application
    - Funnel & Gate Application
- Ex-Situ
  - Hexavalent Chromium Treatment via Fluidized Bed Reactor
  - Hexavalent Chromium Treatment via ZVI Reactor



NERT FEASIBILITY STUDY

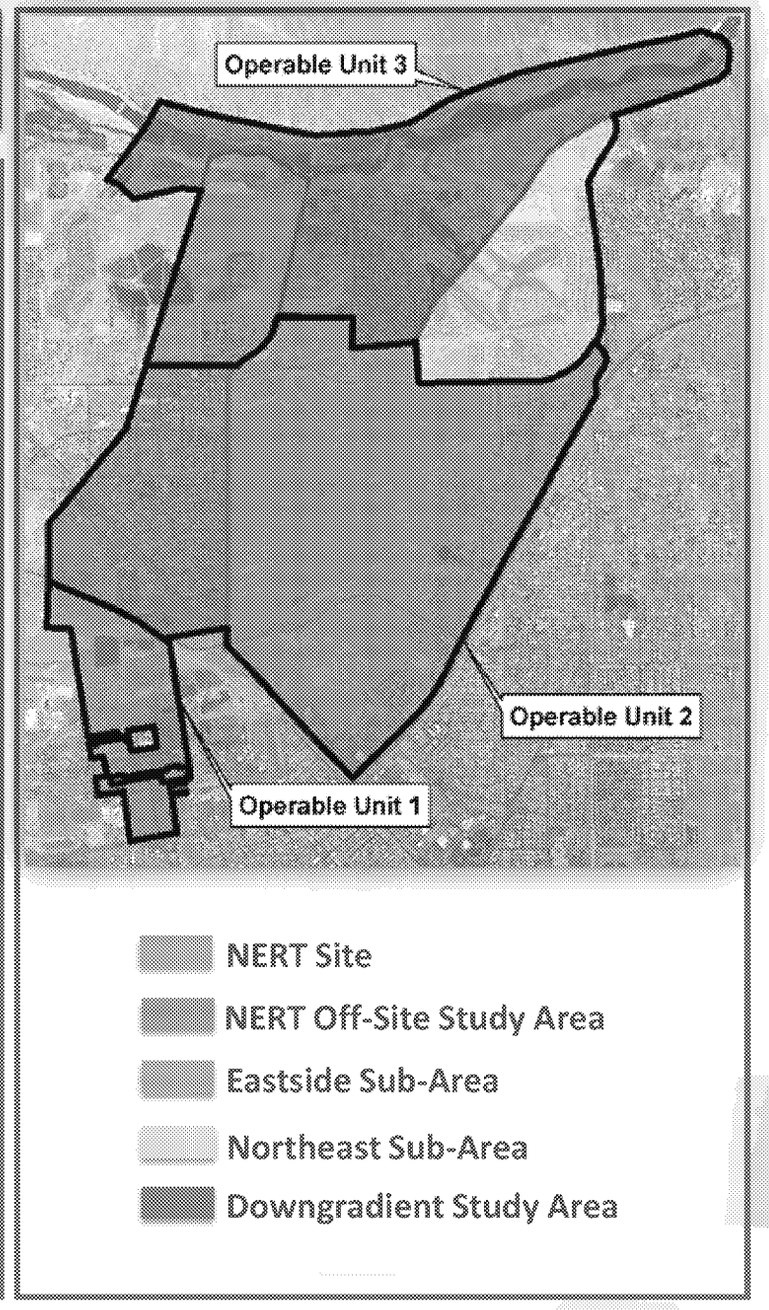
UPCOMING FS DELIVERABLES

2nd Quarter

- Las Vegas Wash Pilot Study Roundtable and Work Plan Addendum
- SWF Area Bioremediation Treatability Study Results Report
- Unit 4 Source Area In-Situ Bioremediation Treatability Study Roundtable and Work Plan Addendum
- Galleria Drive ZVI Treatability Study Roundtable and Work Plan Addendum

3rd Quarter

- In-Situ Bioelectrochemical Laboratory Treatability Study Roundtable and Work Plan Addendum



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PATH TO FINAL REMEDY

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

PATH TO FINAL REMEDY

OVERVIEW OF CERCLA PROCESS

Remedial Investigation

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Risk Assessments

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Feasibility Study

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Proposed Plan

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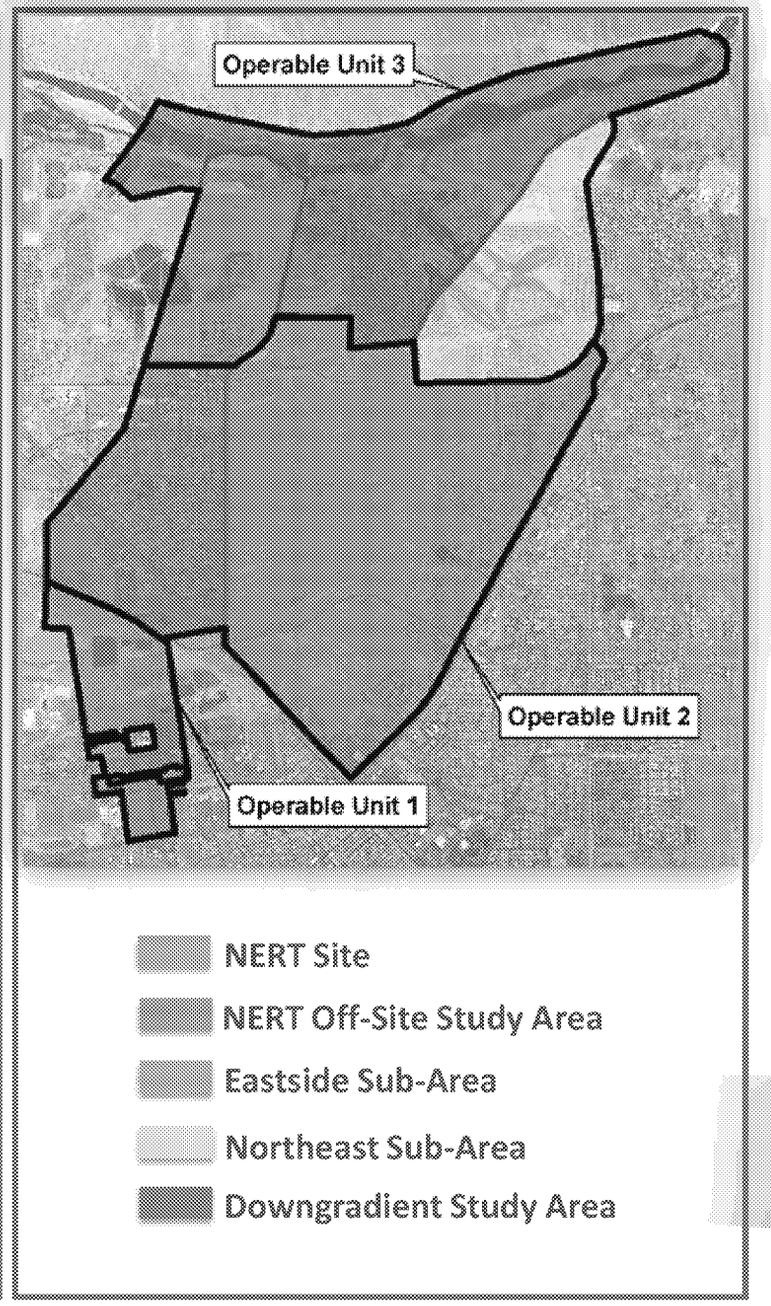
Record of Decision

↓

Remedial Design

↓

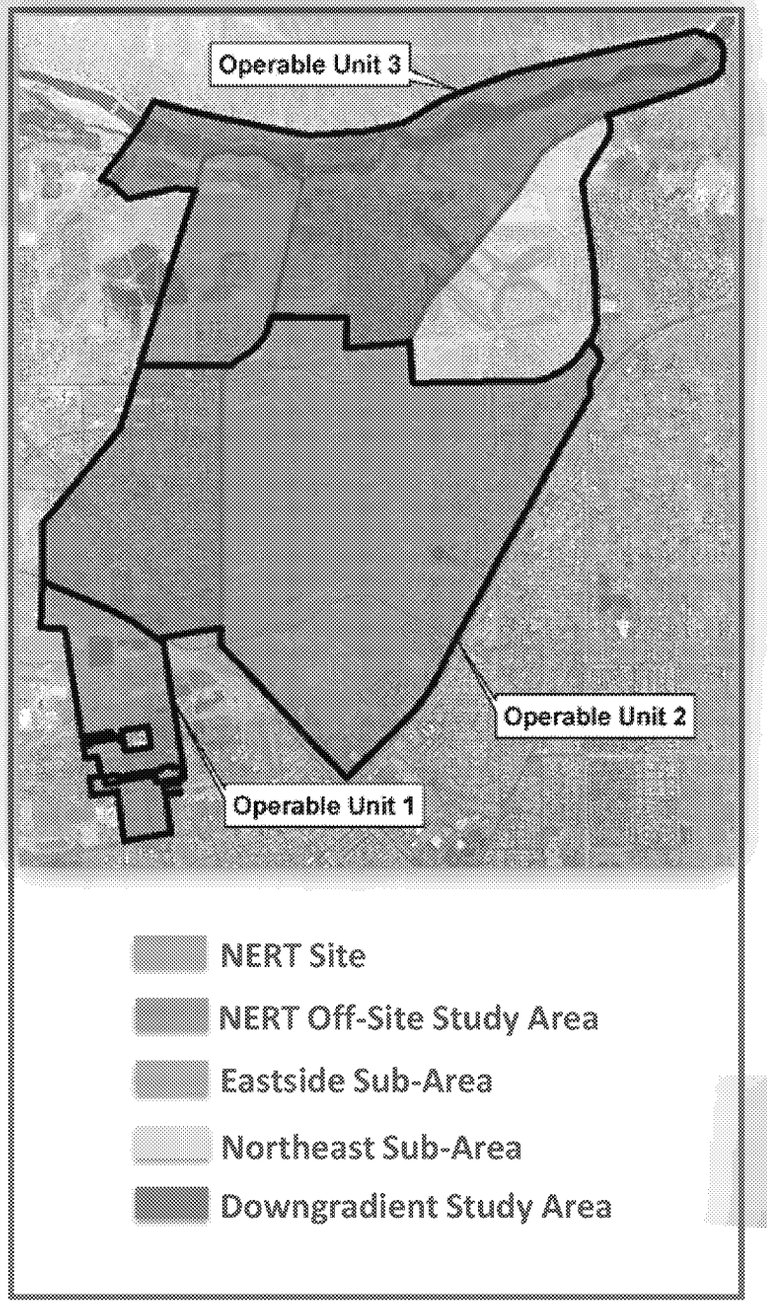
Remedial Action



PATH TO FINAL REMEDY

RISK ASSESSMENT: BASELINE HEALTH RISK ASSESSMENT

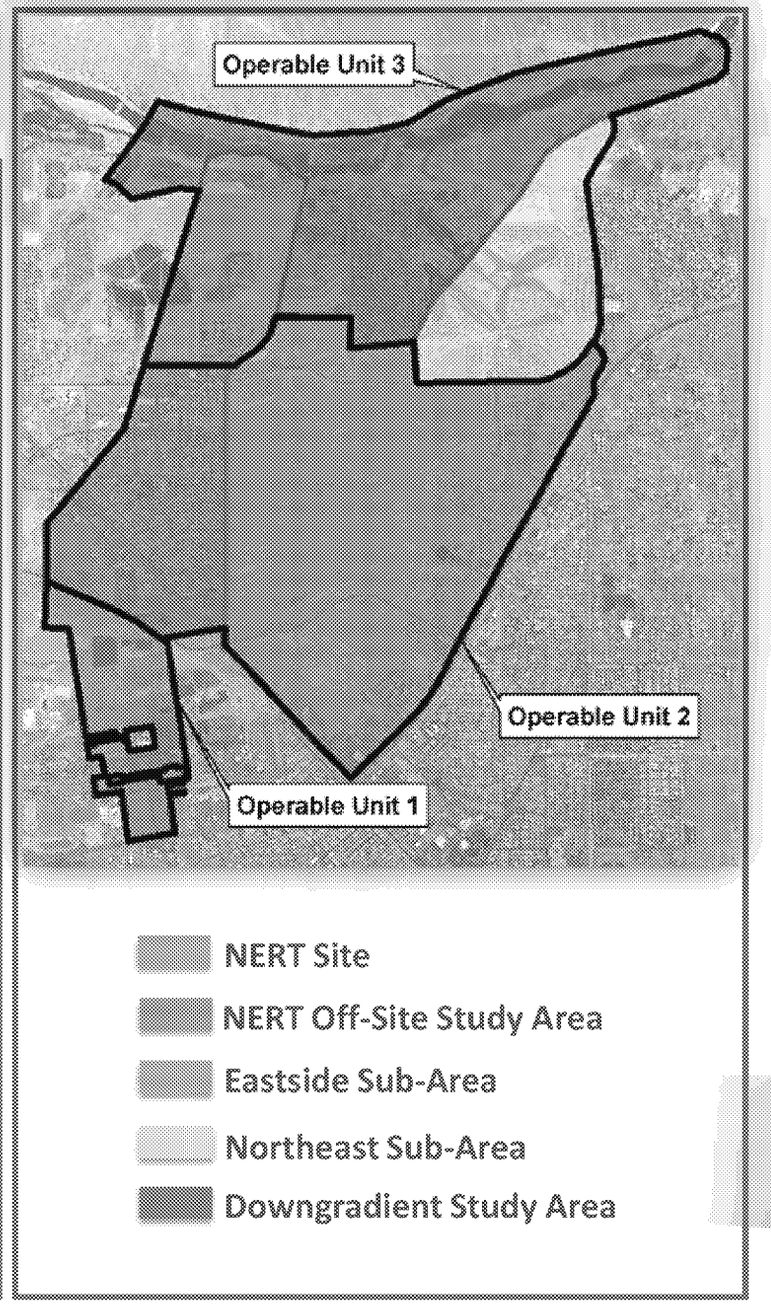
- Process of evaluating risk of cancer and other health effects on humans from the exposure of COPCs via complete exposure pathways (i.e., ingestion, inhalation, direct contact) and exposure setting (i.e., residential, recreational, or commercial/industrial)
  - OU-1 Soil BHRA
  - OU-1 / OU-2 Soil Gas and Groundwater BHRA
  - OU-3 BHRA



PATH TO FINAL REMEDY

RISK ASSESSMENT: ECOLOGICAL RISK ASSESSMENT

- Process of evaluating risk to ecological receptors from the exposure of COPCs via complete exposure pathways and exposure setting (i.e., terrestrial, aquatic)
- Two step process: screening level and baseline
  - OU-1 Refined SLERA
  - OU-2 SLERA
  - OU-3 BERA



PATH TO FINAL REMEDY

FEASIBILITY STUDY

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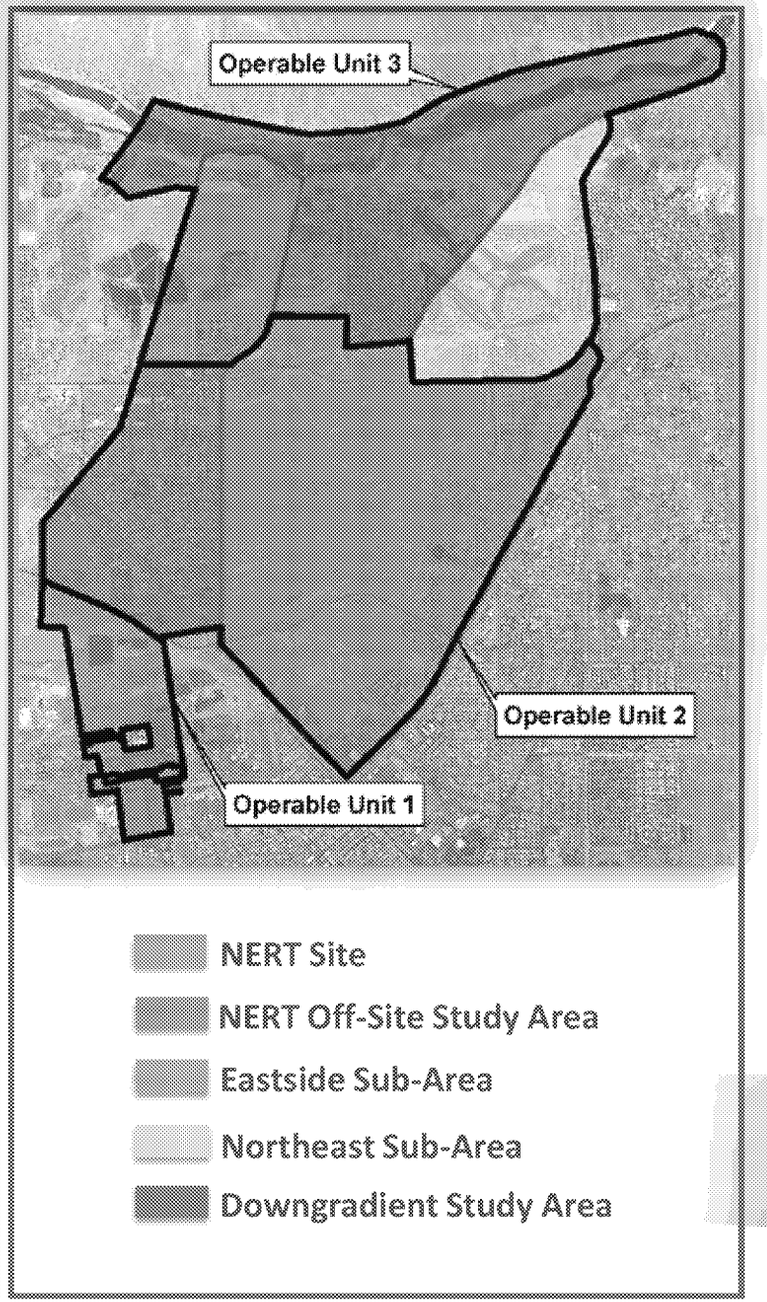
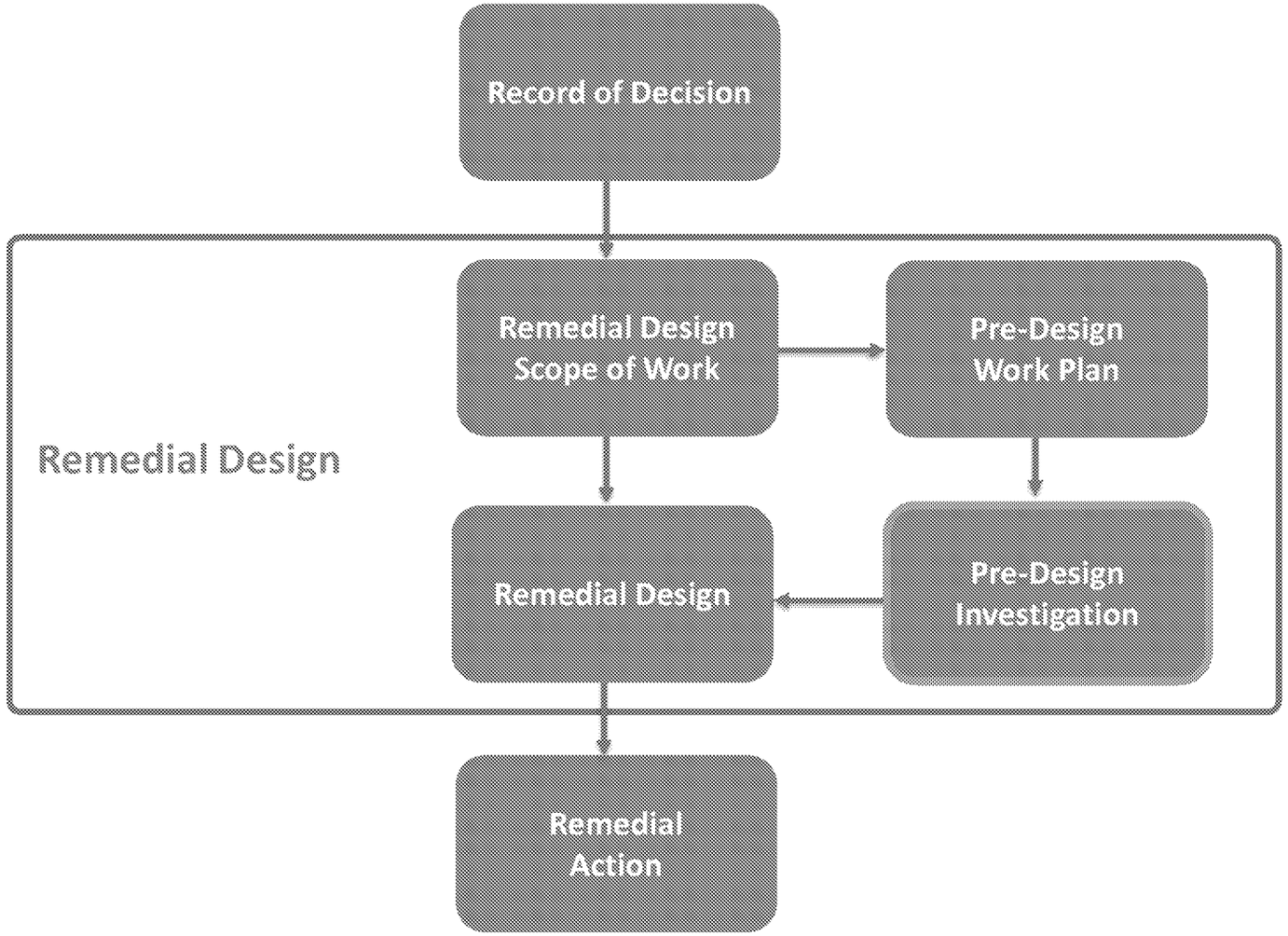


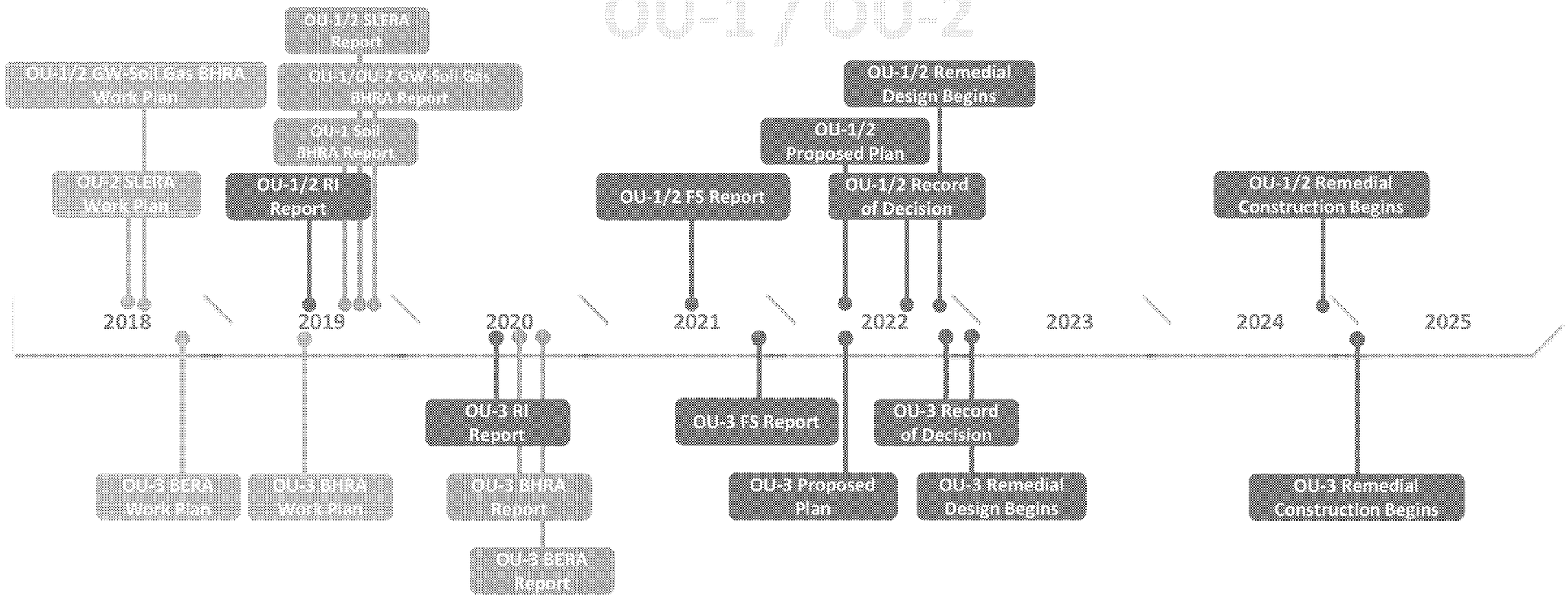
PATH TO FINAL REMEDY

CERCLA PROCESS: AFTER THE RECORD OF DECISION



PATH TO FINAL REMEDY

CERCLA PROCESS TIMELINE



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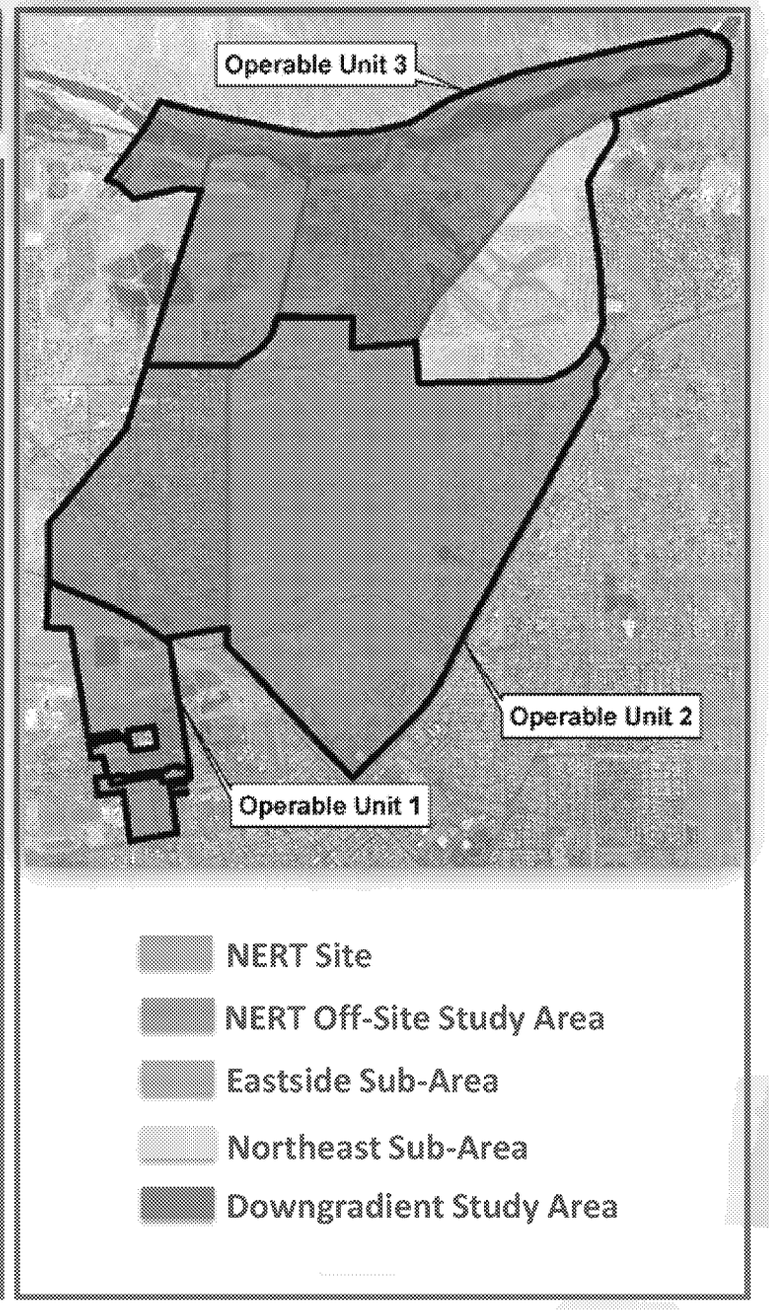
OU-1 CONTAINMENT AND SOURCE REDUCTION CONCEPTUAL ALTERNATIVES

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

OU-1 CONCEPTUAL REMEDIAL ALTERNATIVES

REMEDIAL ACTION OBJECTIVE

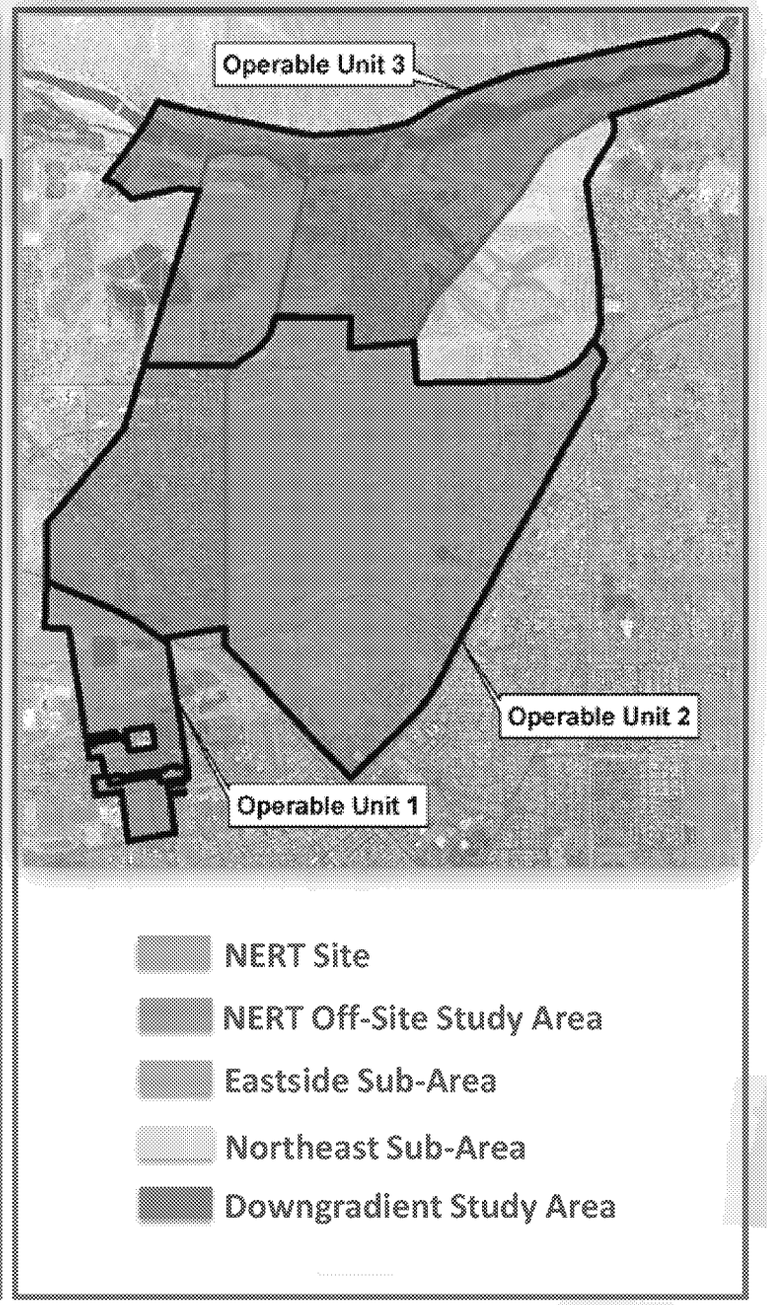
- Site Source Control and Containment
  - To achieve the overall long-term RAO of mitigating the discharge of COPCs in groundwater to the Las Vegas Wash, the migration of COPCs present in groundwater at the NERT Site will be mitigated
  - Specifically, on-site source control and containment at the northern property boundary of the NERT Site will likely be achieved through a combination of the implementation of on-site vadose zone source control and the implementation, as required, of barrier groundwater control options



OU-1 CONCEPTUAL REMEDIAL ALTERNATIVES

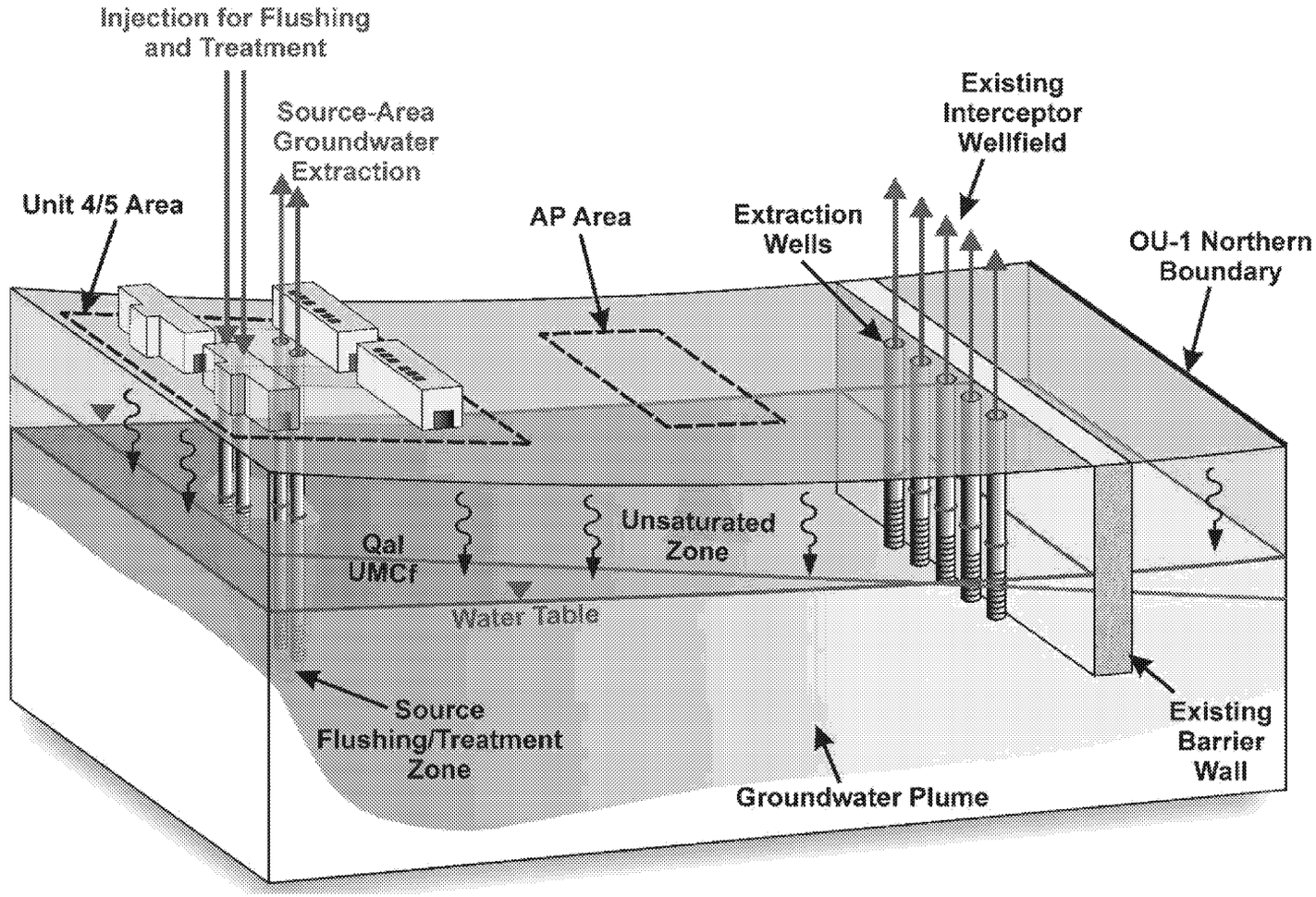
REMEDIAL ACTION ALTERNATIVES

- Potential Site Source Control Alternatives
  - Excavation and off-site disposal of shallow soil
  - Soil flushing of vadose zone
  - Contaminant mass reduction from groundwater using extraction and ex-situ treatment
  - Contaminant mass reduction from groundwater using in-situ bioremediation



OU-1 CONCEPTUAL REMEDIAL ALTERNATIVES

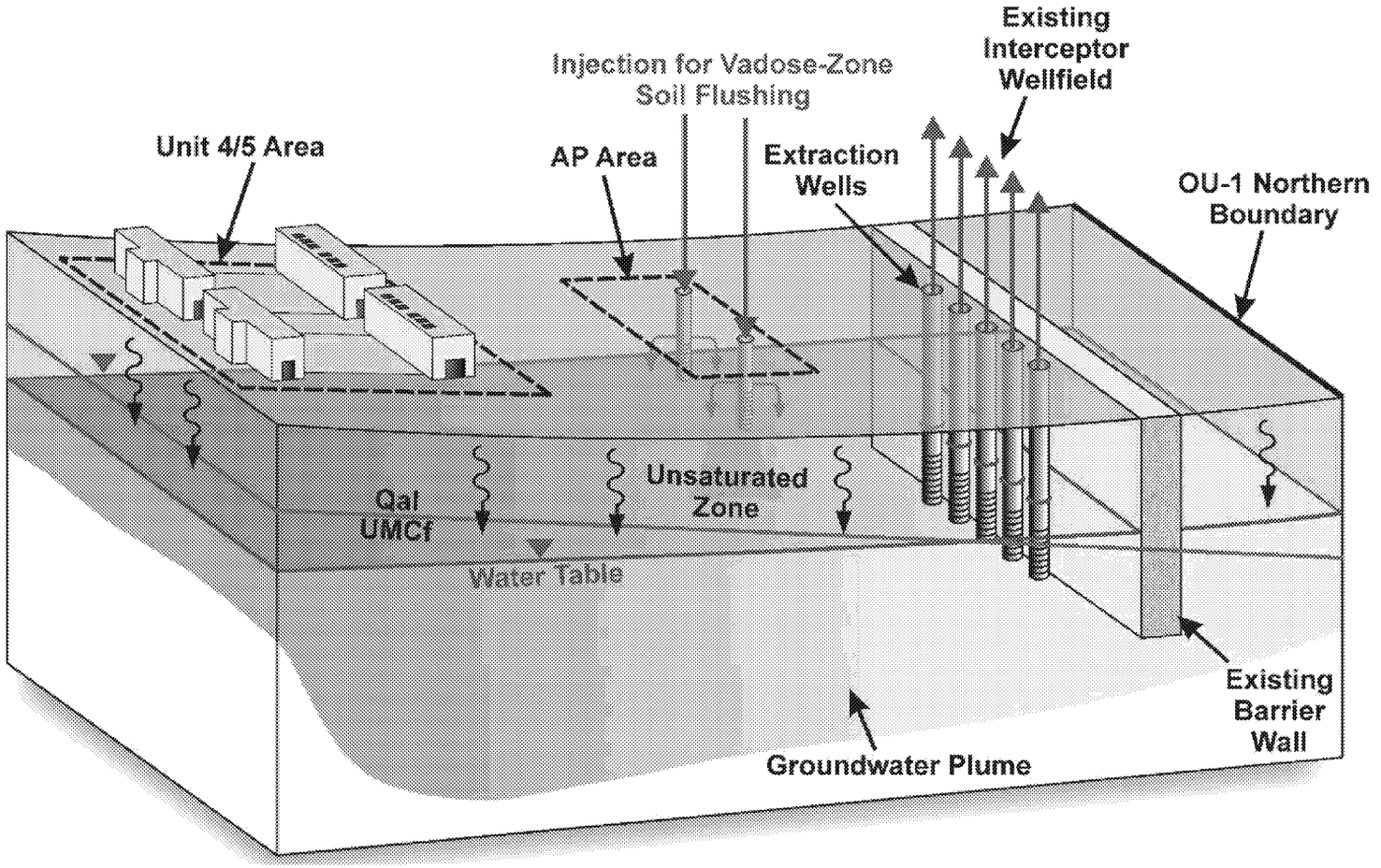
POTENTIAL SOURCE CONTROL OPTIONS



Conceptual Remedial Alternatives are preliminary in nature and are presented for discussion purposes only. The final Remedy to be implemented in OU-1 will be determined consistent with the CERCLA process.

OU-1 CONCEPTUAL REMEDIAL ALTERNATIVES

POTENTIAL SOURCE CONTROL OPTIONS

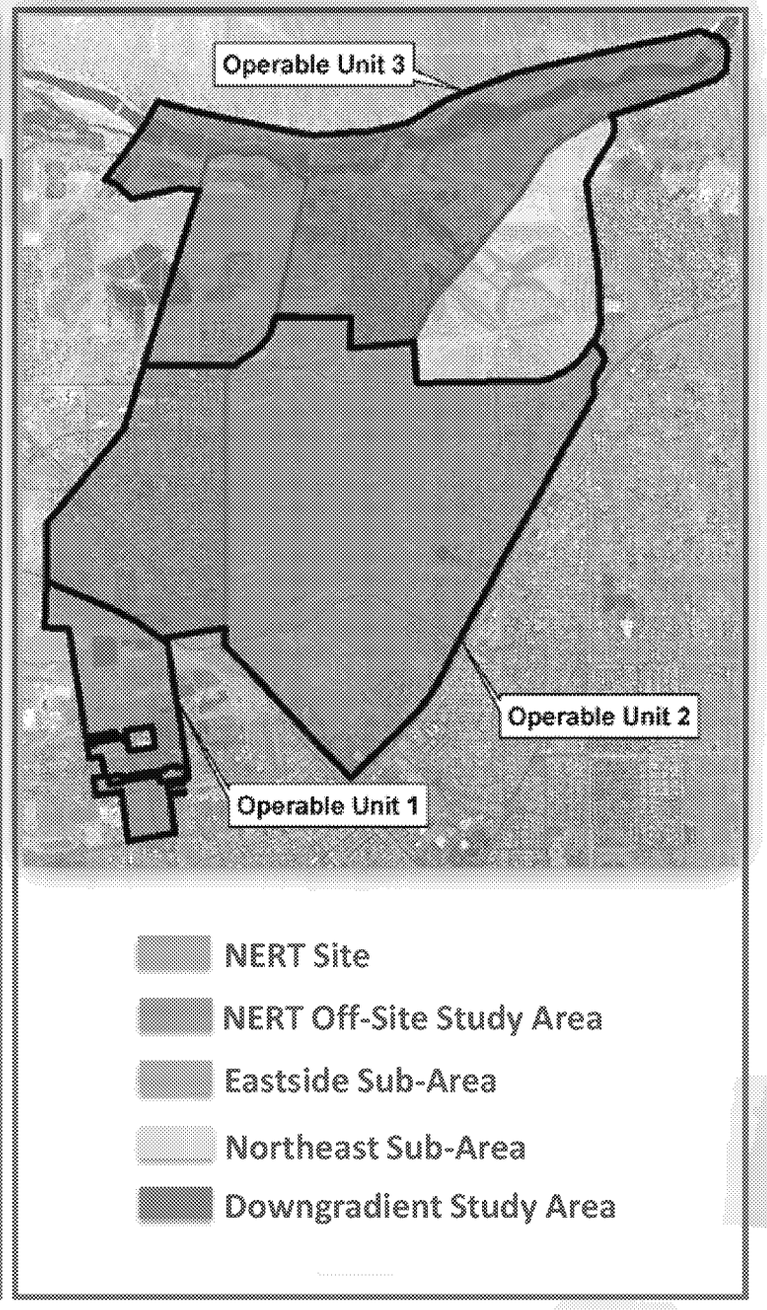


Conceptual Remedial Alternatives are preliminary in nature and are presented for discussion purposes only.
The final Remedy to be implemented in OU-1 will be determined consistent with the CERCLA process.

OU-1 CONCEPTUAL REMEDIAL ALTERNATIVES

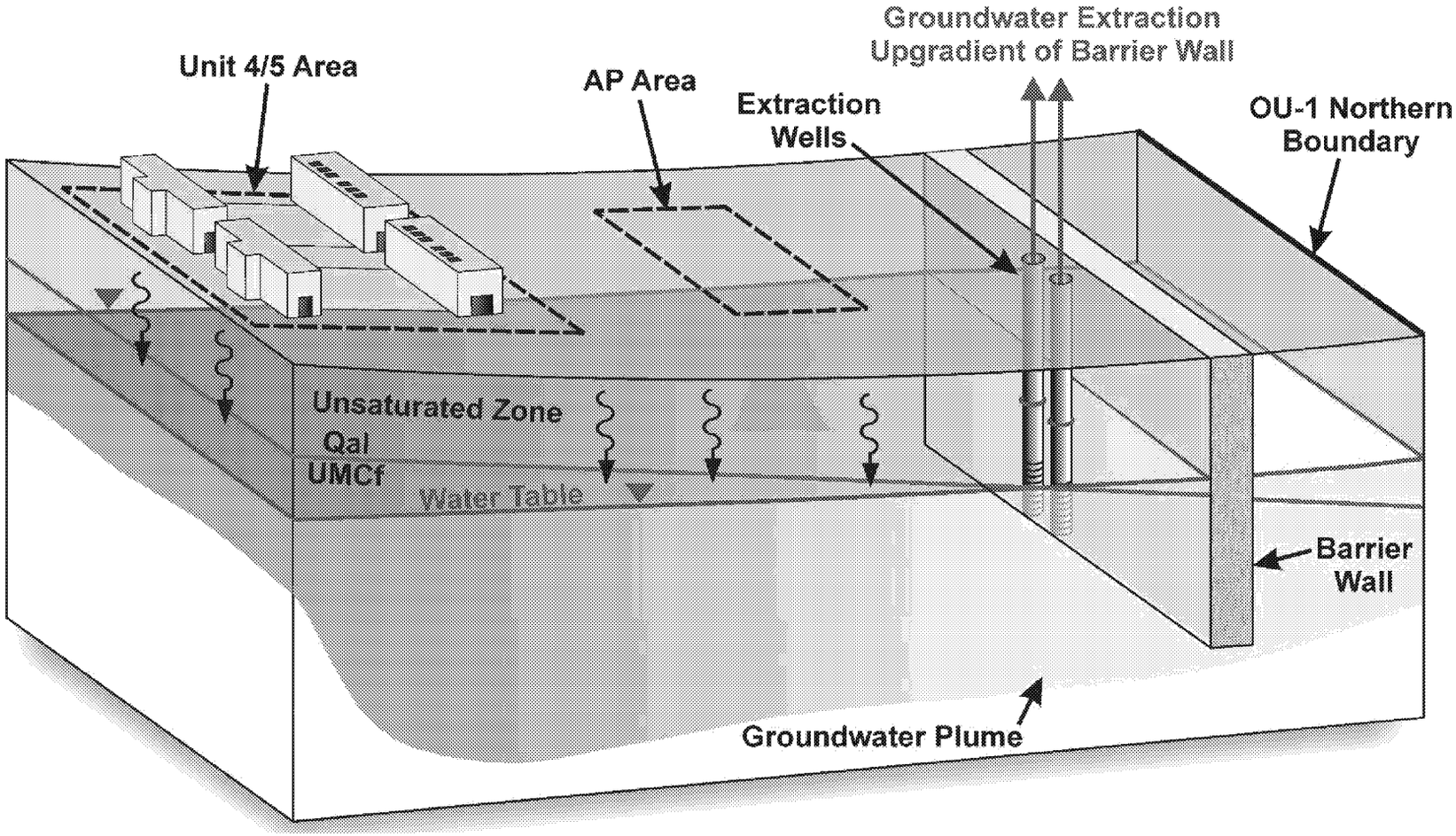
REMEDIAL ACTION ALTERNATIVES

- Potential Containment Alternatives
  - Barrier Wall and groundwater extraction at the property boundary providing groundwater control
  - Ex-situ treatment of extracted groundwater providing contaminant mass reduction
  - In-situ treatment of groundwater at the property boundary providing contaminant mass reduction
  - Funnel and gate system at the property boundary providing contaminant mass reduction



OU-1 CONCEPTUAL REMEDIAL ALTERNATIVES

POTENTIAL CONTAINMENT ALTERNATIVES



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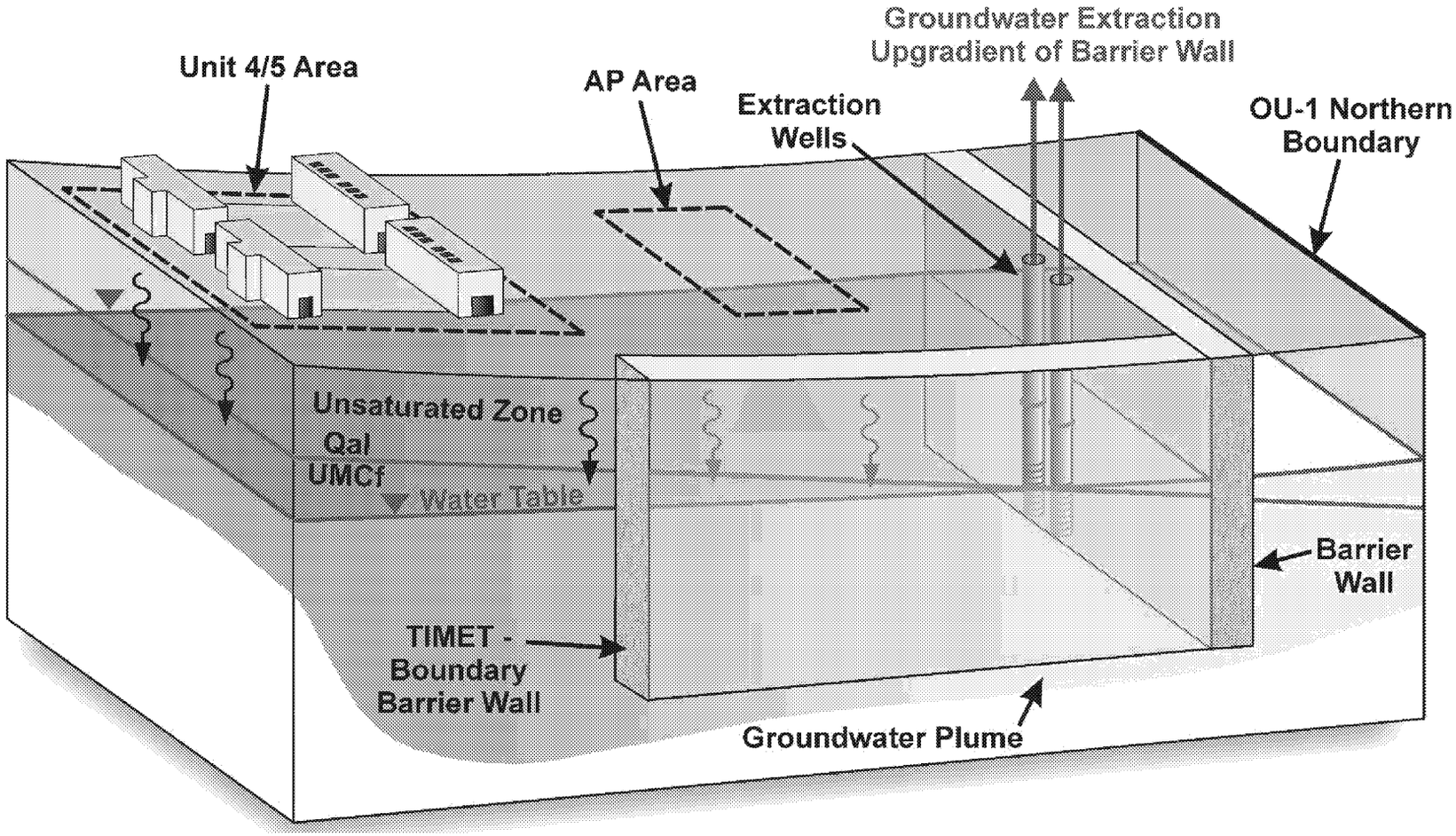

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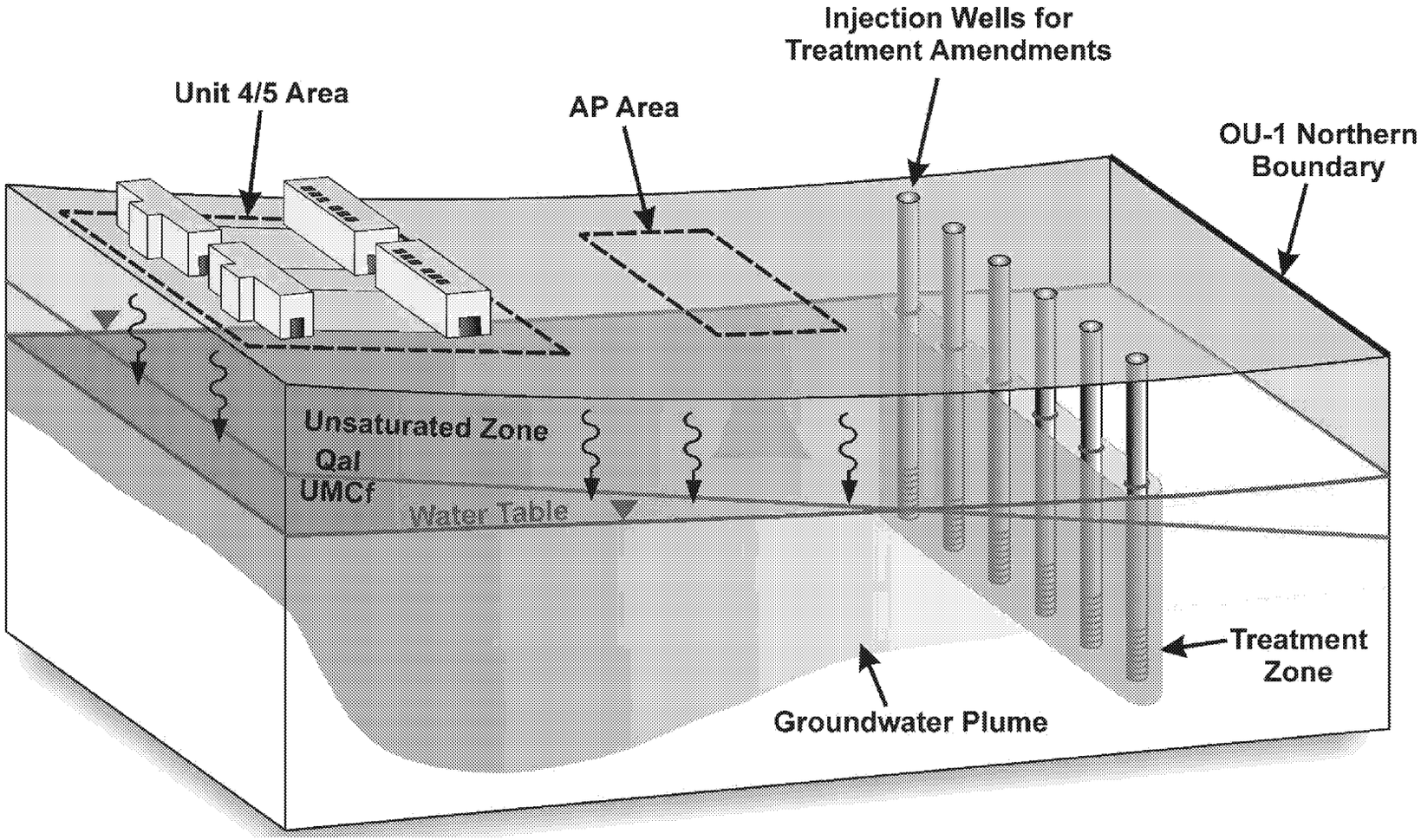
POTENTIAL CONTAINMENT ALTERNATIVES



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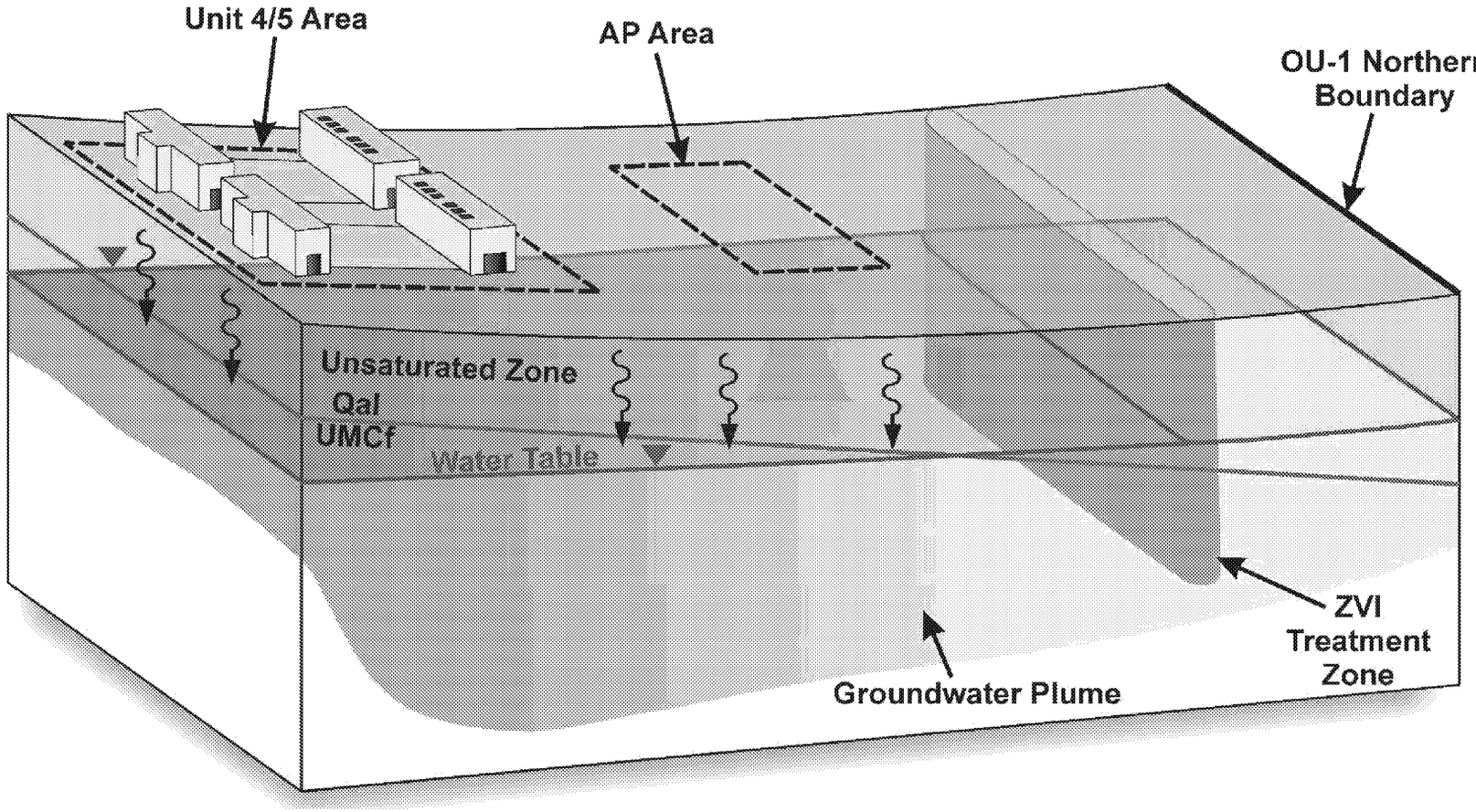

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OU-1 CONCEPTUAL REMEDIAL ALTERNATIVES

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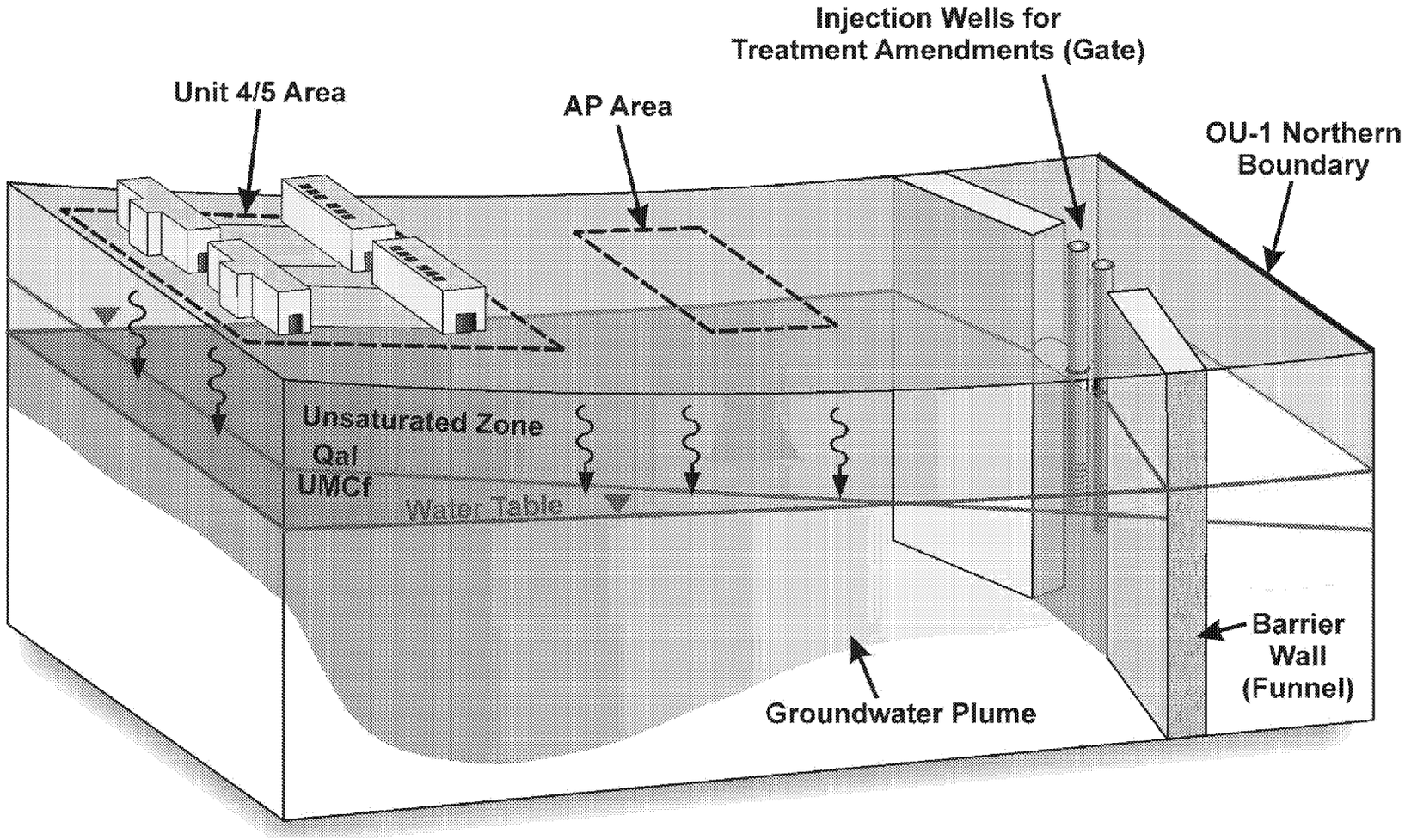

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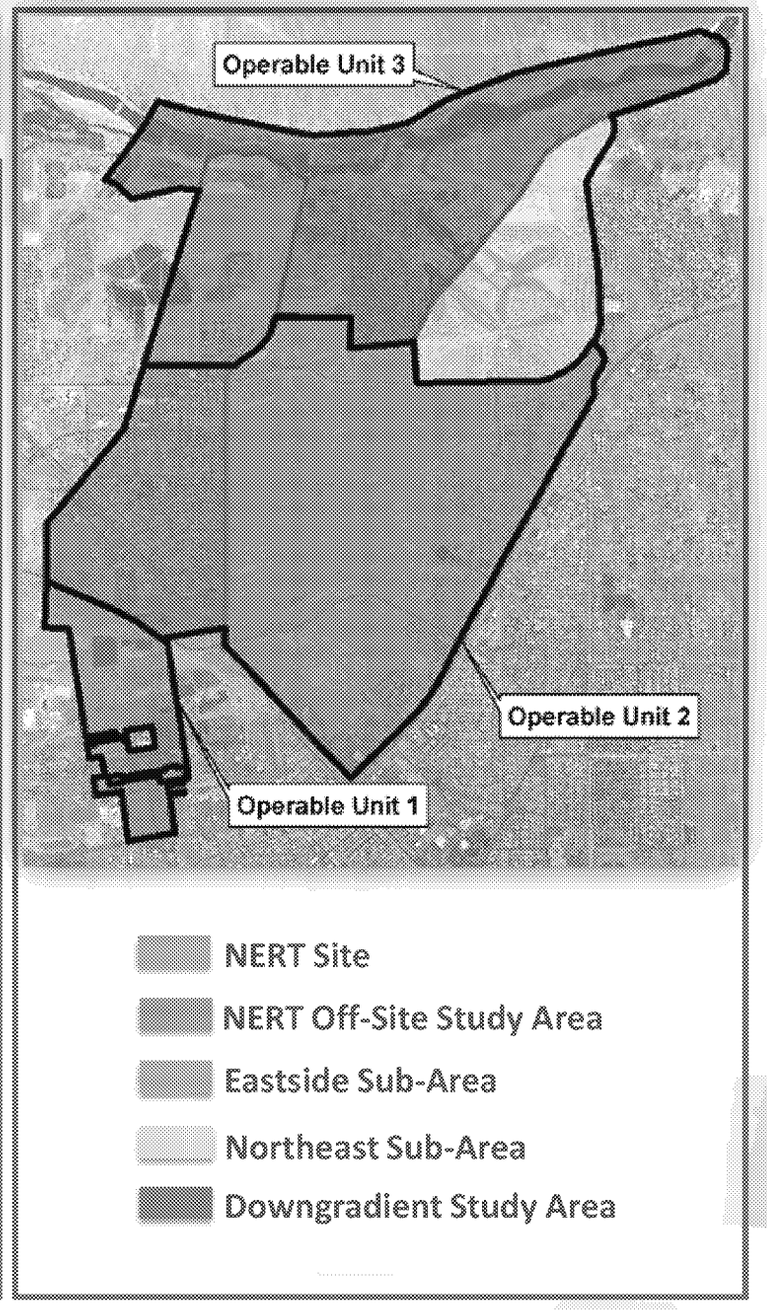
OU-1 CONCEPTUAL REMEDIAL ALTERNATIVES

NEXT STEPS

- OU-2 Conceptual Remedial Alternatives discussion in Q4 2019
- FS Roundtable in Q1 2021
- FS Report for OU-1 and OU-2 to be submitted in Q2 2021



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GWETS

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

GWETS

SYSTEM STATUS

GWETS COMPONENT	STATUS	COMMENTS
Extraction Wells	Condition Normal	Average total extraction rate at ~1,260 gpm
Lift Stations / Pipelines	Condition Normal	Increased pigging implemented; coagulant pilot study complete; and coagulant change planned
GW-11 : Volume	35MG ~19 days available	Desired available volume > 17 days; Long-term plan to decommission
Chromium Treatment Plant	Condition Normal	Accepting ~70 gpm from IWF and AP Area Extraction Wells
Biological Treatment Plant	Condition Normal	Processing AP-5 material at ~2 gpm
Ion Exchange Treatment Plant	Condition Normal	Accepting ~180 gpm of 760 gpm generated from SWF

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TREATMENT SYSTEM EXTENSION

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

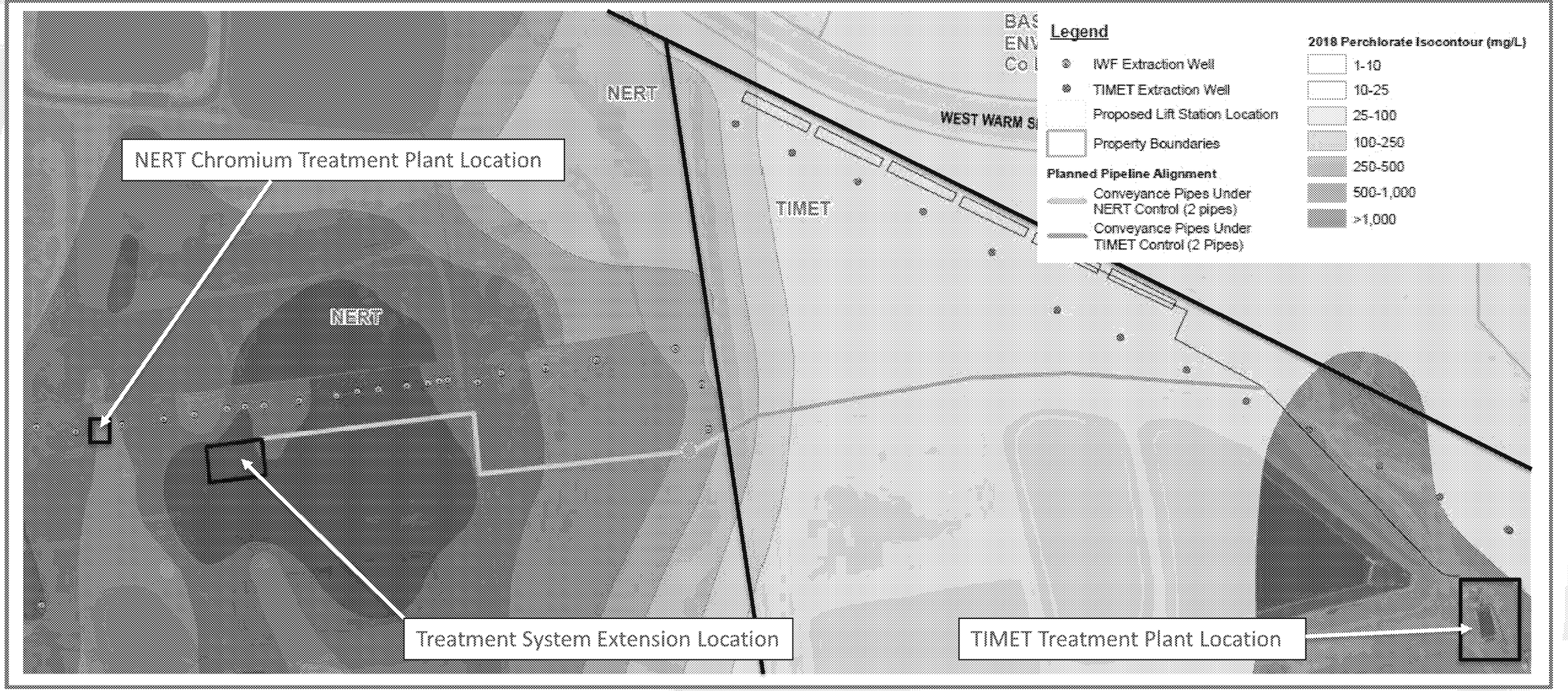
TREATMENT SYSTEM EXTENSION

INTRODUCTION

- TIMET initiated operation of a groundwater treatment and extraction system in March 2014
- TIMET extracts groundwater at the downgradient edge of its property, treats it to remove VOCs, and returns the treated water to the subsurface via infiltration trenches
- The groundwater also contains perchlorate and hexavalent chromium migrating from the NERT Site
- NDEP is modifying TIMET's permit to address perchlorate and hexavalent chromium
- After TIMET has removed the VOCs, NERT will receive the groundwater, process it in a small FBR system, and return the treated water to TIMET

TREATMENT SYSTEM EXTENSION

SYSTEM LAYOUT



TREATMENT SYSTEM EXTENSION

TREATMENT TECHNOLOGIES EVALUATED

- Based on the information provided by the Trust and TIMET, and additional sampling conducted by Envirogen (ETI), various ex-situ solutions were evaluated and included:
  - Ion Exchange for Chromium and Perchlorate removal (two stage IX)
  - Chemical Precipitation for Chromium removal followed by Ion Exchange for Perchlorate removal
  - Chemical Precipitation for Chromium removal followed by Biological treatment for Perchlorate removal
  - Chemical Addition followed by Biological treatment for Chromium and Perchlorate removal

TREATMENT SYSTEM EXTENSION

TREATMENT TECHNOLOGY SELECTED

- Based on various factors evaluated, fluidized bed reactor (FBR) technology was selected as the most cost effective system to remove chromium and perchlorate to permitted effluent criteria
- Design Concepts:
  - Up to 100 gpm (10% of GWETS flow rate)
  - Donor: Acetic acid
  - Operated by ETI operators from single control room
  - Treated water pumped back to TIMET to infiltration trenches

TREATMENT SYSTEM EXTENSION

NEXT STEPS

- Finalize design and submit to BWPC for approval
- BWPC to issue modified UIC permit
- Construct treatment plant extension
- Develop an Operations and Maintenance Manual
- System startup and operation

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AP-5 PROJECT STATUS

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

AP-5 PROJECT STATUS

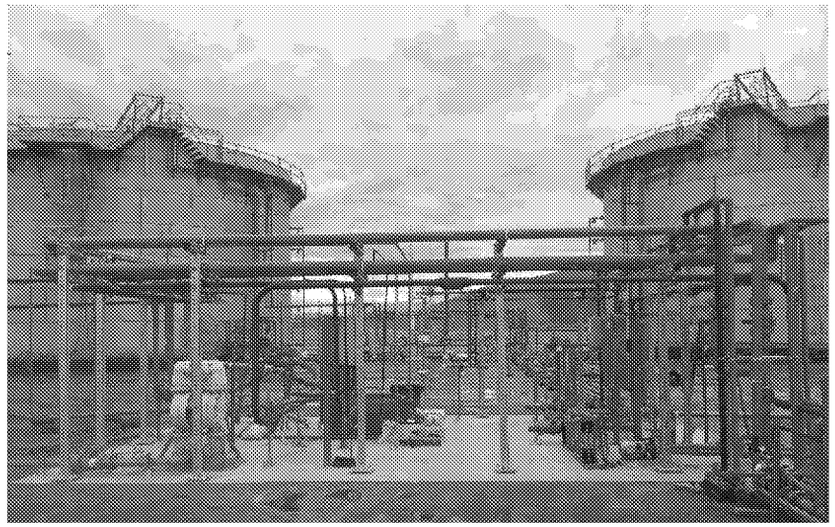
AP-5 POND CLOSURE

- Completed transfer of 2,300,000 gallons of sediment and solids containing 1,400,000 pounds of perchlorate
- Removed, washed, and disposed of 70,000 square feet of liner
- Excavated 11,000 tons of contaminated berm material for off-site disposal

AP-5 PROJECT STATUS

AP LIQUIDS / SEDIMENT TREATMENT

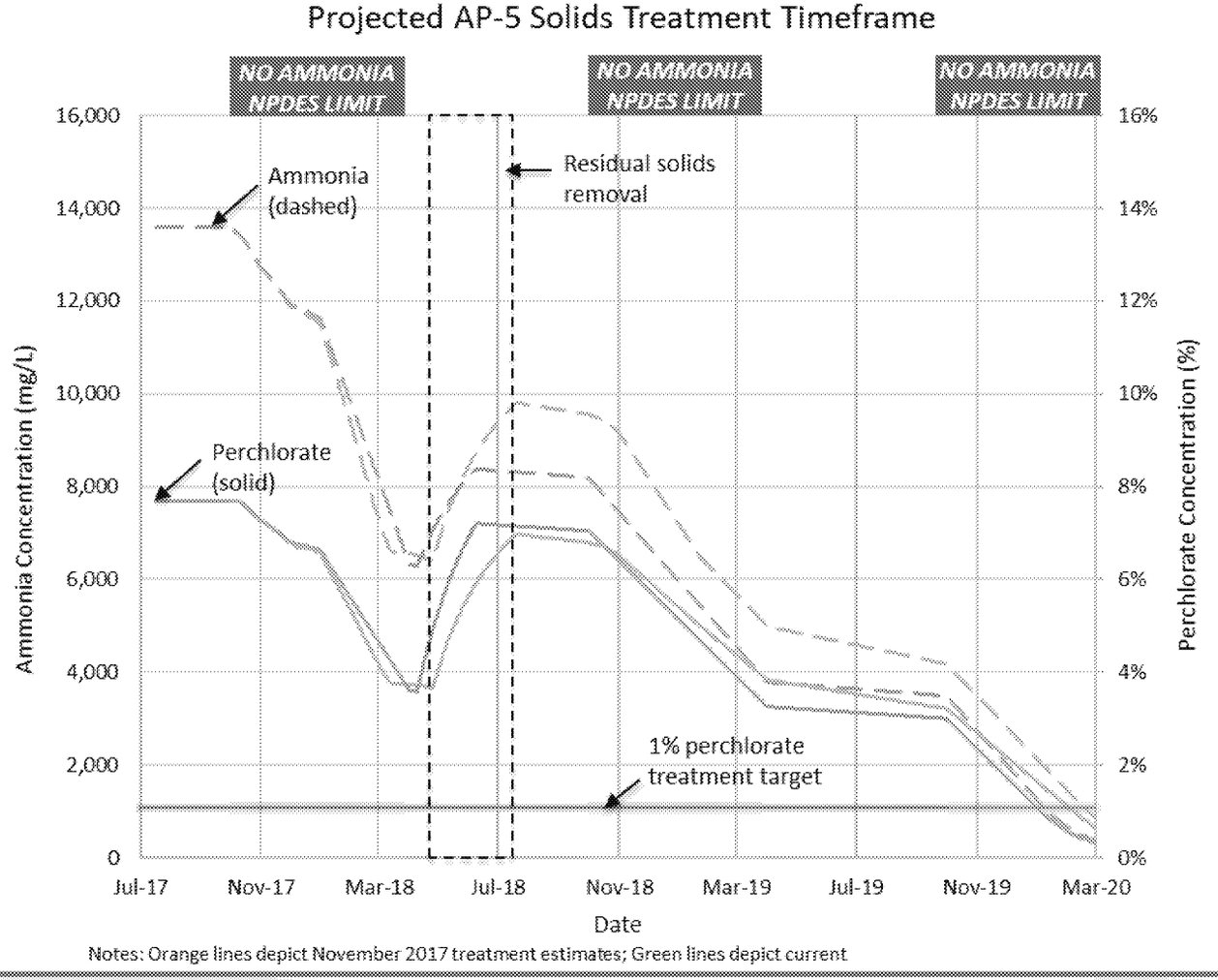
- Currently treating AP-5 wash water through FBRs at 10 gpm at 2% perchlorate
- As of February 2019, Tetra Tech decanted more than 2,266,000 gallons of AP wash water and transferred the liquids to the Day Tank
- More than 4,120,000 gallons of diluted decant has been treated through the FBRs
- Estimated 779,000 lbs of perchlorate has been destroyed through the FBRs



AP-5 PROJECT STATUS

AP LIQUIDS / SEDIMENT TREATMENT

- AP-5 Pond sediment washing and treatment ongoing
- Current projections show treatment to continue through 1st quarter 2020
- Next steps:
  - Install solids dewatering infrastructure
  - Complete solids dewatering and disposal following completion of treatment



Notes: Orange lines depict November 2017 treatment estimates; Green lines depict current

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WEIR DEWATERING TREATMENT SYSTEM DECOMMISSIONING

MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

WEIR DEWATERING TREATMENT SYSTEM

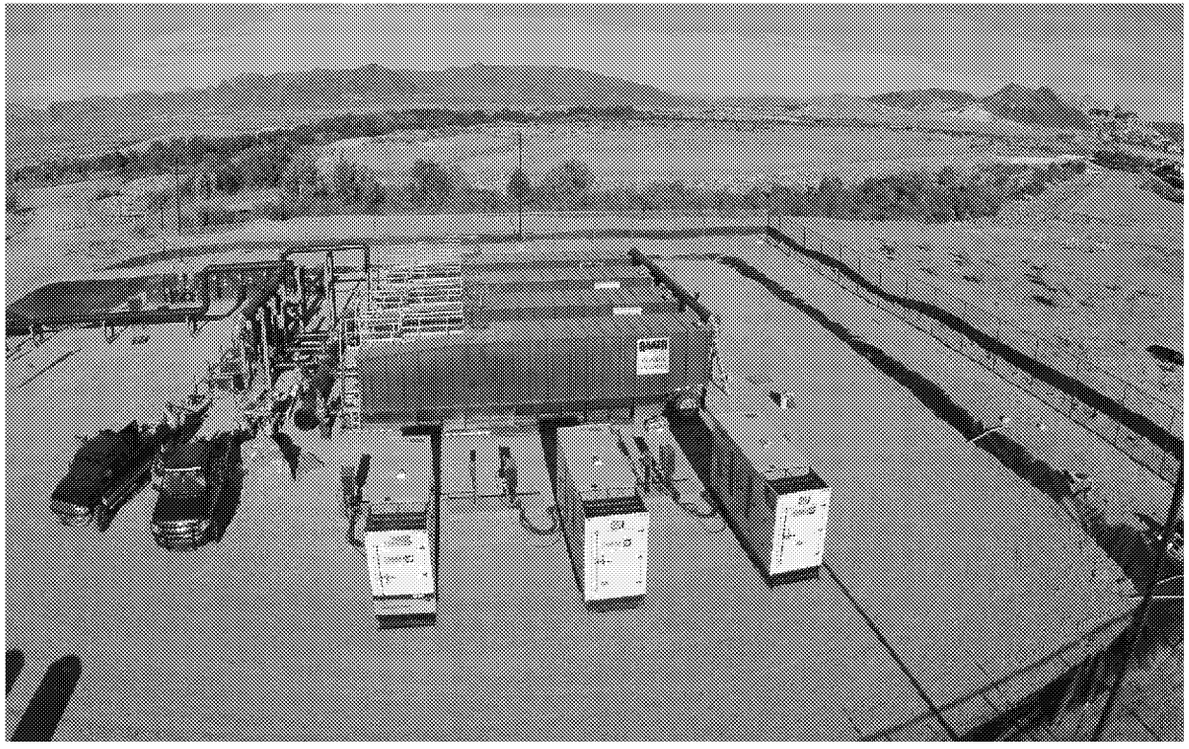
DECOMMISSIONING

- Plant decommissioning included removal and recycling or disposal of:
  - Approximately two miles of steel piping
  - Over 27,000 cubic feet of concrete
  - 2.5 acres of HDPE liner
- Select equipment retained by NERT for potential future reuse
- Ownership of select Plant equipment exchanged in return for Plant demolition services

WEIR DEWATERING TREATMENT SYSTEM

DECOMMISSIONING

Constructed

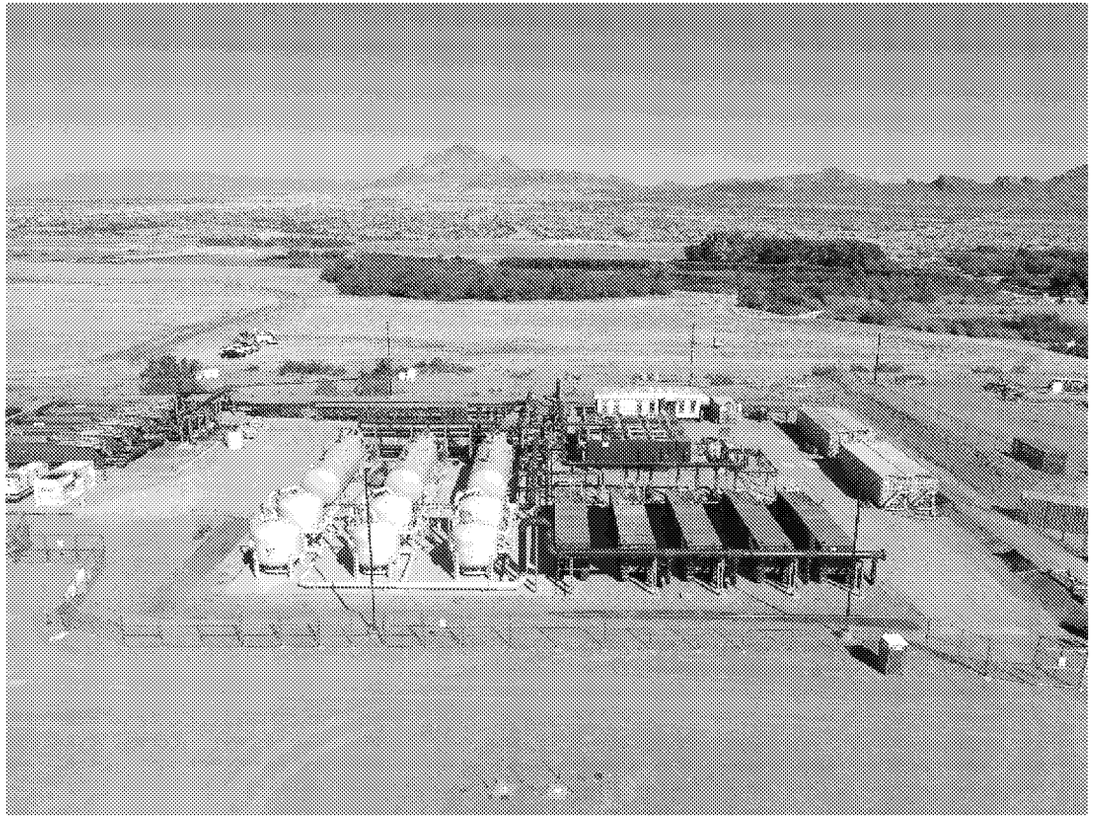


Near Demolition Completion

WEIR DEWATERING TREATMENT SYSTEM

DECOMMISSIONING

Constructed



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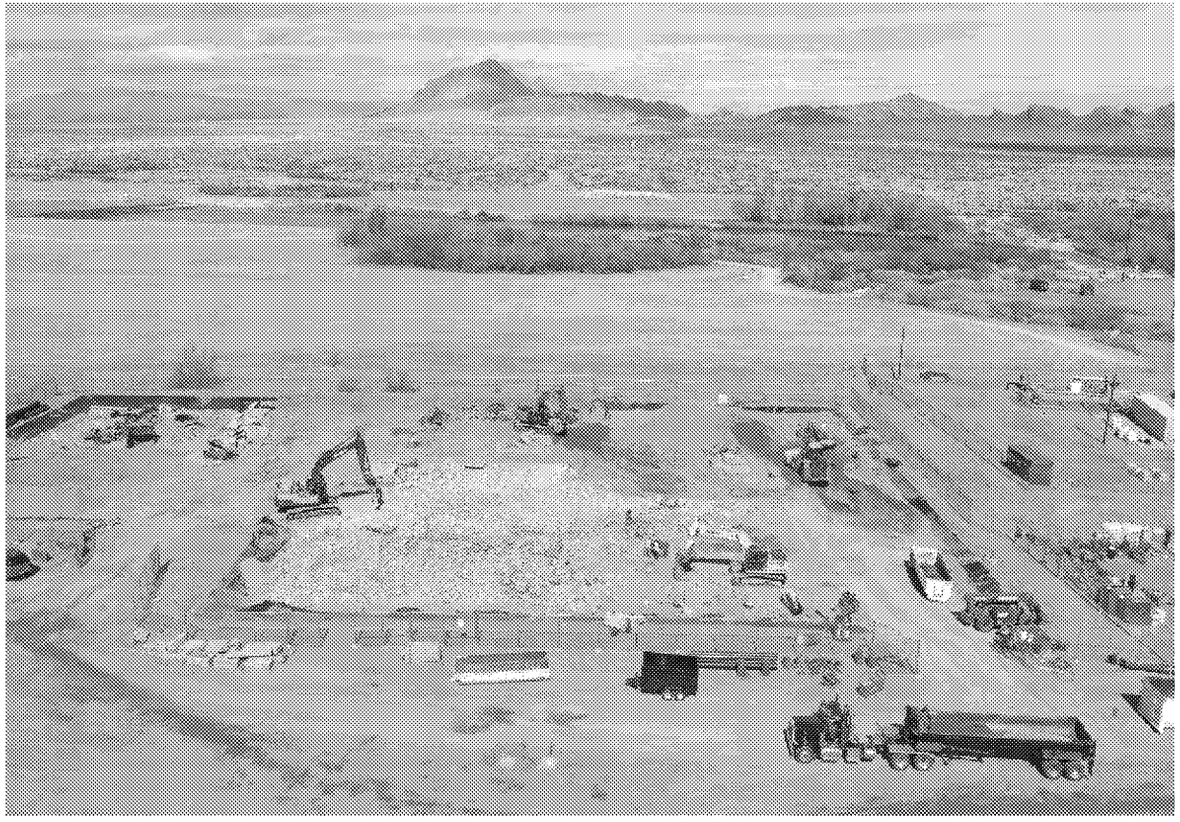

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2019 PROJECT DELIVERABLES

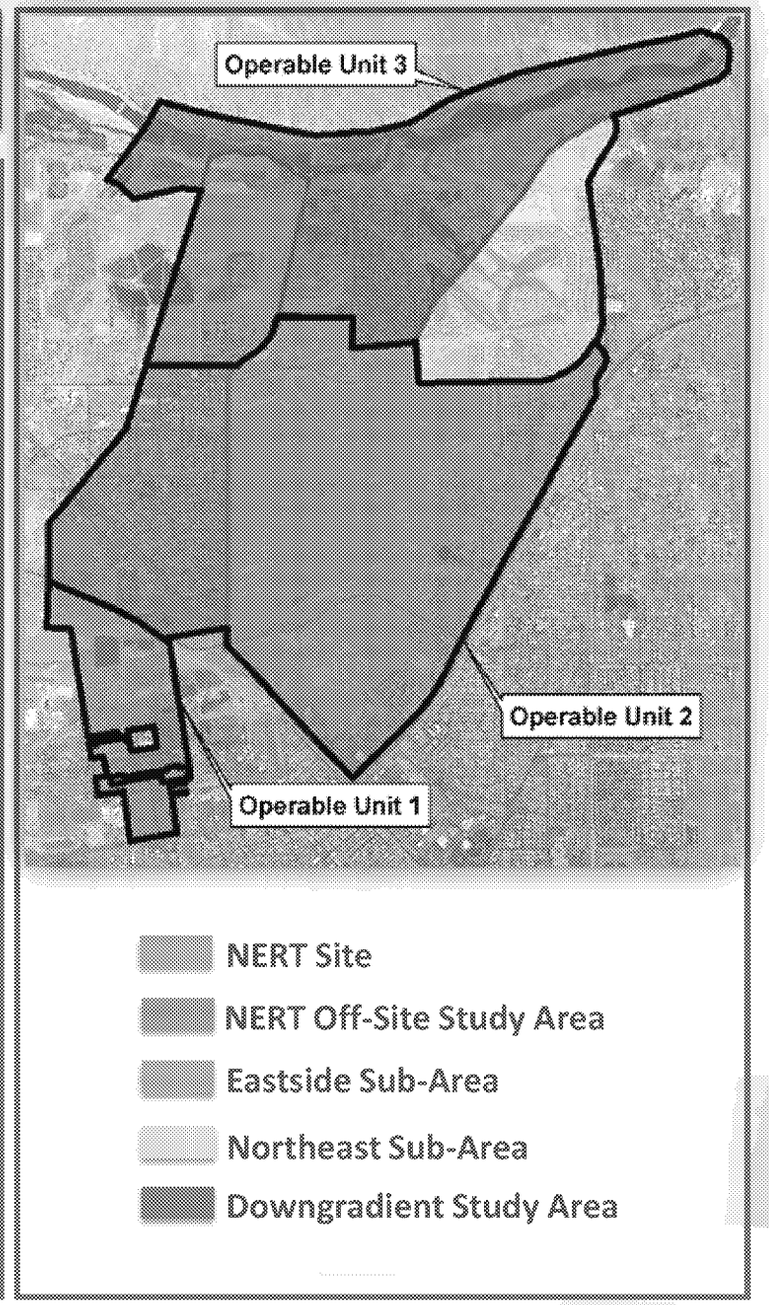
MARCH 20, 2019 ANNUAL STAKEHOLDER MEETING

2019 PROJECT DELIVERABLES

UPCOMING DELIVERABLES

2nd Quarter

- Semi-Annual Remedial Performance Memorandum
- OU-3 BHRA Work Plan
- Remedial Investigation Report for OU-1 and OU-2
- Las Vegas Wash Pilot Study Roundtable and Work Plan Addendum
- SWF Area Bioremediation Treatability Study Results Report
- Unit 4 Source Area In-Situ Bioremediation Treatability Study Roundtable and Work Plan Addendum
- Galleria Drive ZVI Treatability Study Roundtable and Work Plan Addendum



2019 PROJECT DELIVERABLES

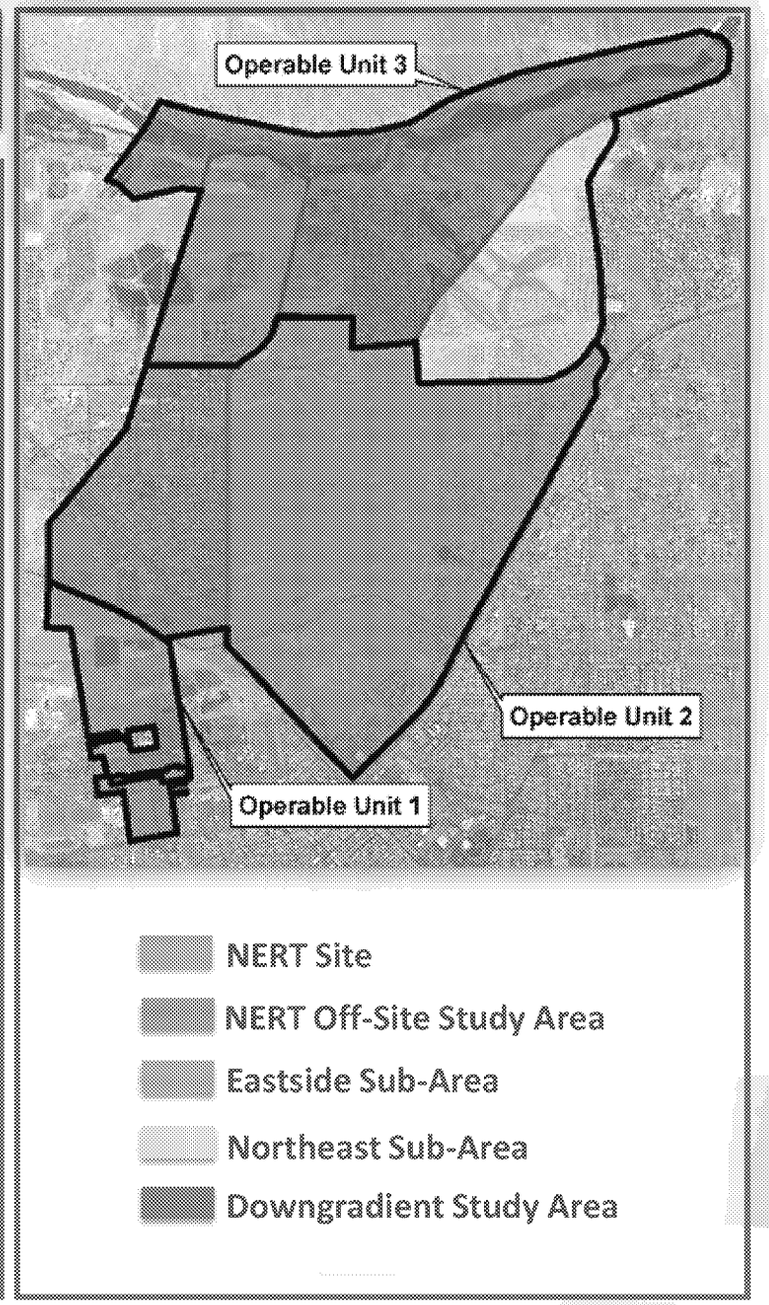
UPCOMING DELIVERABLES

3rd Quarter

- OU-1 Soil BHRA Report
- OU-1 and OU-2 SLERA Reports
- In-Situ Bioelectrochemical Laboratory Treatability Study Roundtable and Work Plan Addendum

4th Quarter

- Annual Remedial Performance Report
- Phase 6 Groundwater Model
- OU-1 and OU-2 Soil Gas and Groundwater BHRA Reports
- Parcel E HRA Report



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QUESTIONS / CLOSING REMARKS

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